Metal Finishing

POLISHING AND BUFFING · BARREL FINISHING · CLEANING
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DECEMBER, 1960

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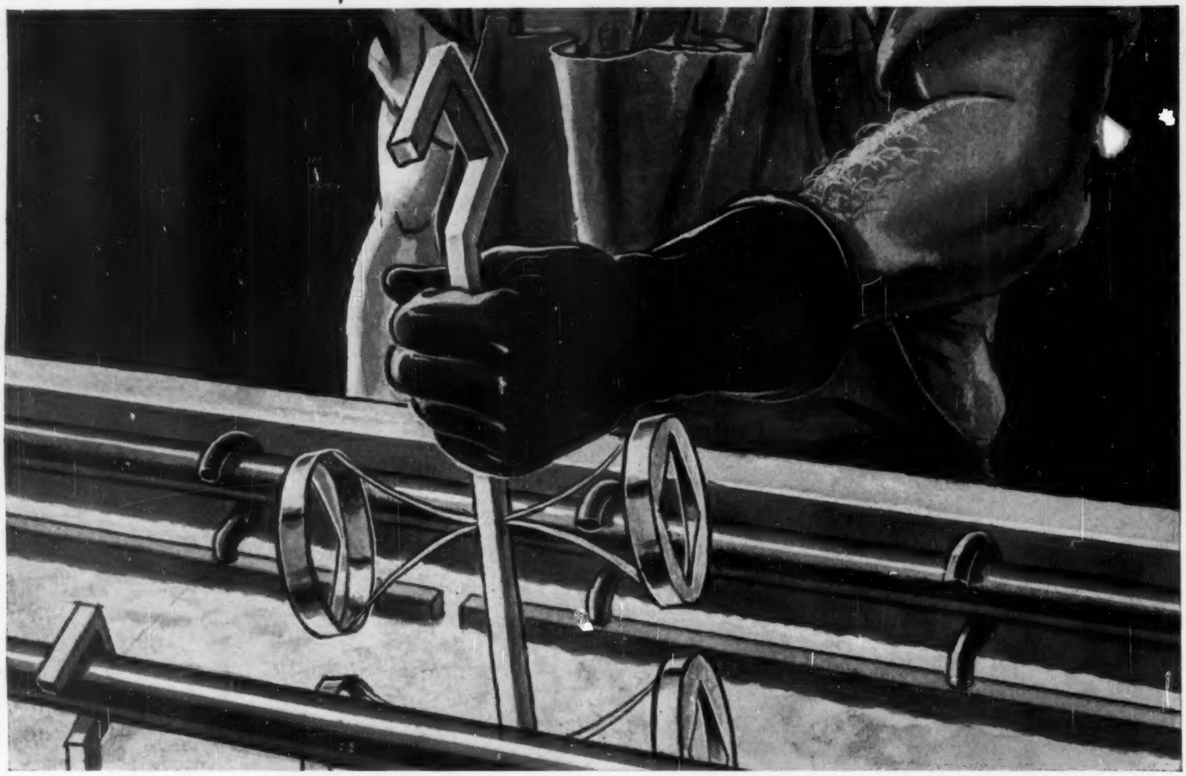

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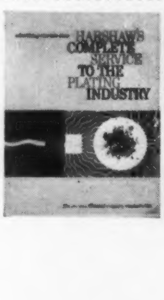

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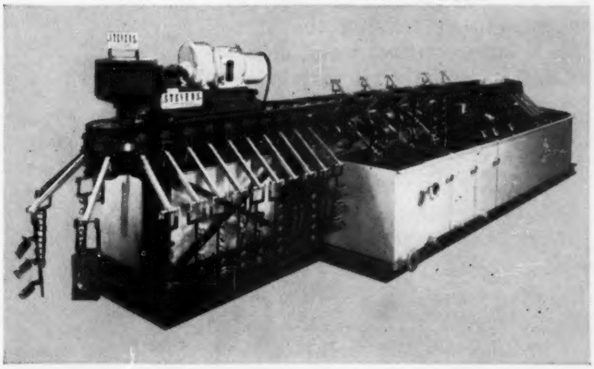

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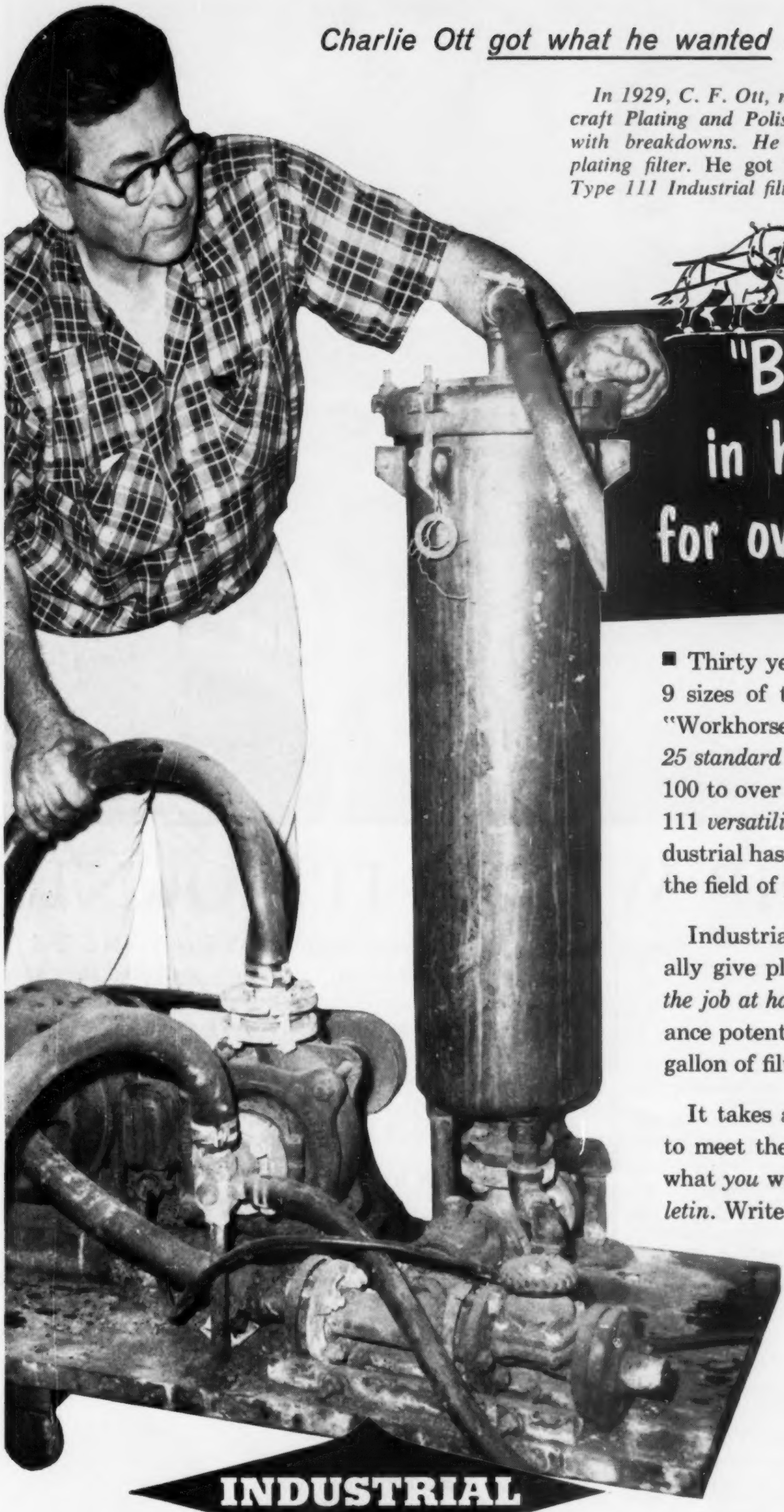

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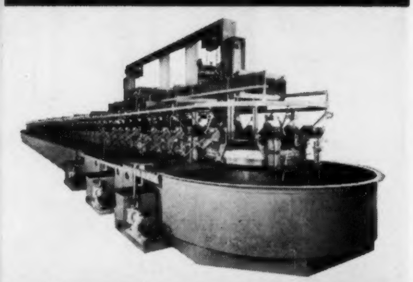

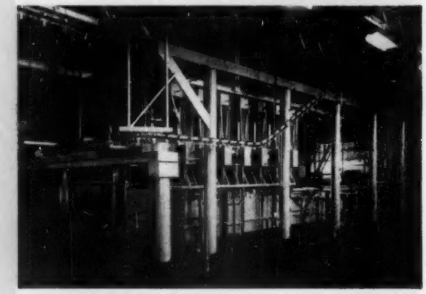

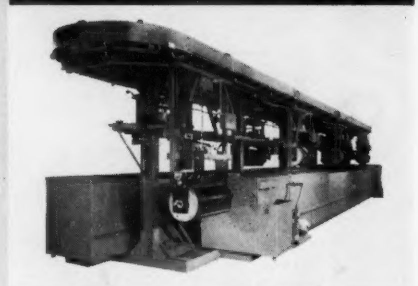

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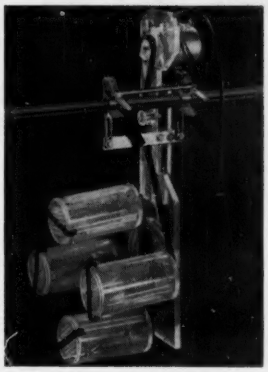

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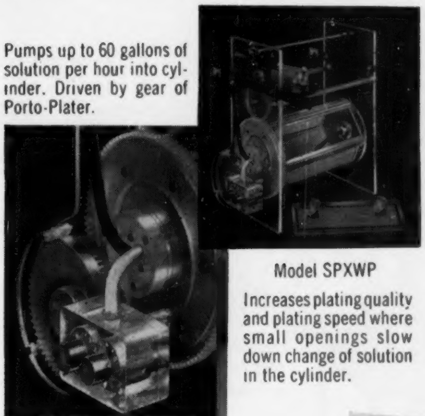

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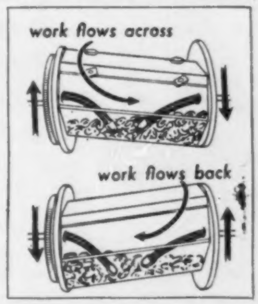

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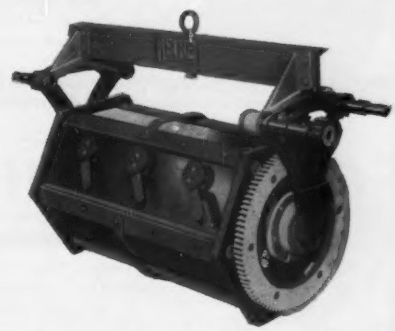

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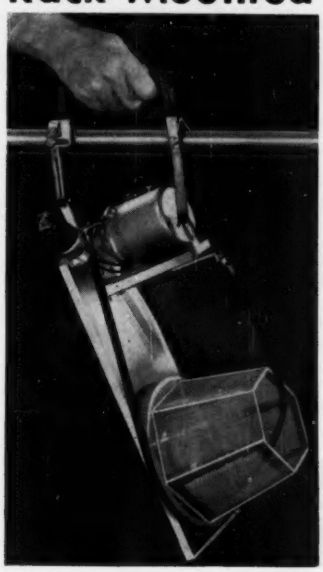

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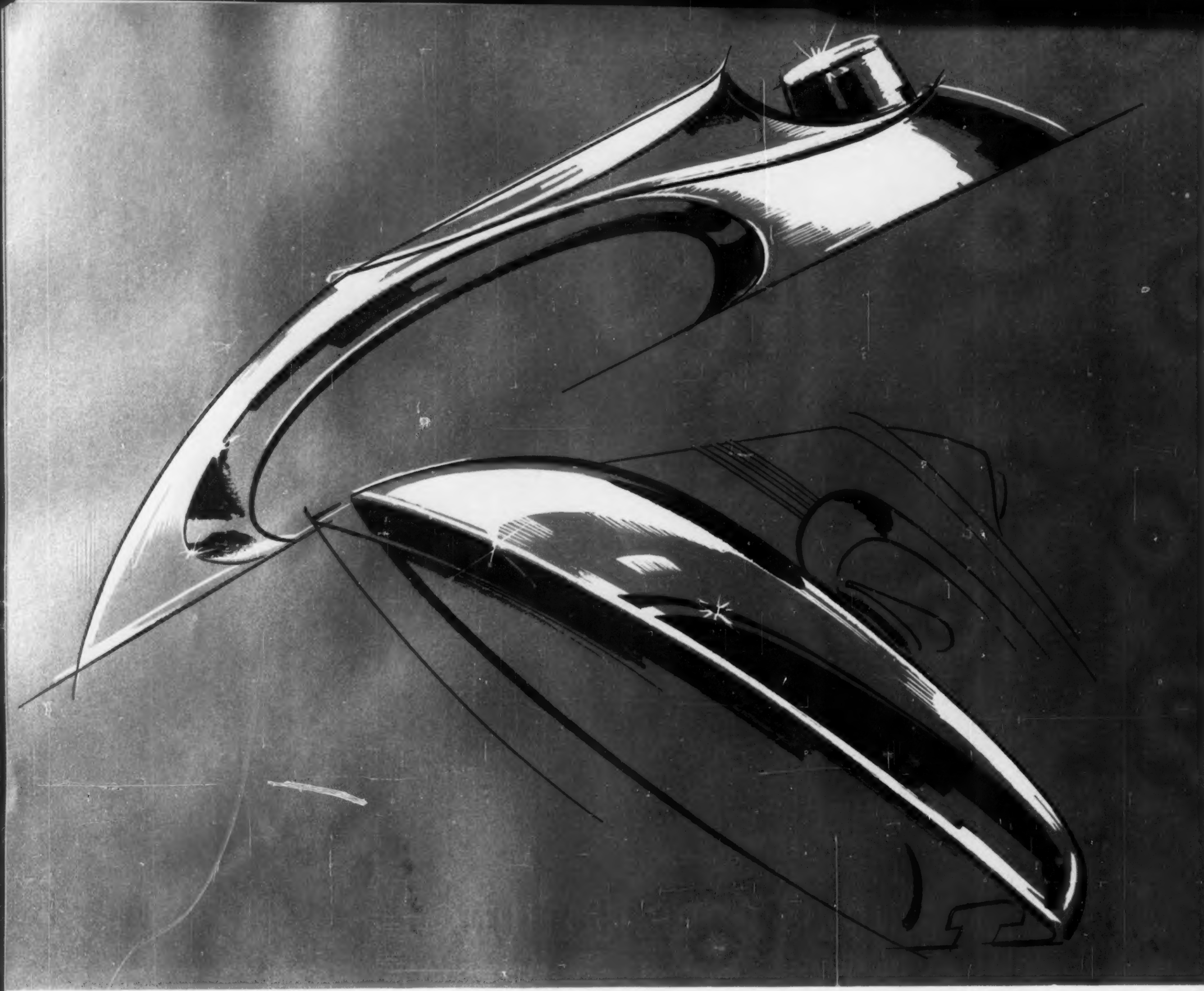

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FEATURES

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Metal Finishing

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ESTABLISHED 1903 VOLUME 58 • NUMBER 12 • DECEMBER, 1960

SOME YEAR-END THOUGHTS

As the end of each year has approached, when good will and thoughts of pleasant things predominate, we have tried to add our bit by pointing out why the metal finisher isn't as badly off as he often had occasion to suspect during the course of the year, when technical and production problems seemed to plague him incessantly. For a change we will consider how the industry can insure for the editor a year of satisfaction and gladness.

In the course of spreading the learned word, our editorial sensibilities are upset regularly by being confronted with the fact that so many writers, at this date, are still unaware of the difference between "base" and "basis" metal, especially when, as occasionally happens, it slips by the blue pencil, and is brought to our attention by an irate reader who attributes the lapse to a mental block on the part of the editor. Also, many finishers have never learned that there is really a distinction between "adherence" and "adhesion," even though the omnipresence of this subject certainly warrants employing correct terminology.

We are on less firm ground when we have to make and support a decision as to terms on which the industry itself hasn't yet made up its mind. "Chromatizing" has already been practically superseded by "chromating," but "phosphatizing" is still just about as popular as the shorter "phosphating." We always use the latter but, since Webster appears to have been won over to the opposition, we are in no position to argue the point, especially with advertisers. We have decided to take the path of least resistance and to follow the crowd with regard to "deburring," but admit to experiencing a twinge whenever we remind ourselves that the *correct* verb is "burring."

These are some of the matters which trouble the editor. Not very important, of course, but we like to think of metal finishing as a science and, as such, it deserves correct usage, to say the least. Although this scribe grew up in an era when "anoids" and "cadium" were perfectly acceptable terms, when copper solutions came both "sweet" and "sour," and when any clear finish was called a lacquer while all pigmented coatings were known as enamels, he still considers himself somewhat more open-minded than a mid-Victorian dowager when it comes to modern things. However, the recent predilection for "operating parameter" when referring to operating conditions or variables could set science back years, in addition to spoiling the editor's day.

Nathaniel Hall

Metal Finishing

Wishes You A Very Merry Christmas and A Happy and Prosperous New Year

Nickel-Chromium Plated Aluminum Sheet

Atmospheric Corrosion Resistance

By R. C. Spooner and D. P. Seraphim,* *Aluminium Laboratories Ltd., Kingston, Ontario, Canada*

Abstract

PANELS of 3S aluminum alloy, plated with bright chromium (Cu/Ni/Cr deposit) by the zincate, Vogt, and phosphoric acid anodizing preplating processes were exposed outdoors in semi-rural and severe industrial atmospheres for up to 2 years. Good performance, particularly in freedom from blistering or flaking was shown by panels treated by phosphoric acid anodizing, although minimum nickel thicknesses were only 1.0 mil or less. The panels processed by the zincate and Vogt techniques with nickel thicknesses less than 1.5 mils failed within a year of industrial exposure, due to severe blistering. Improved weathering resistance was shown by panels plated by all three procedures as the nickel thickness was increased. Panels for severe industrial exposure conditions require a minimum of 1.5 mils nickel. Application to aluminum alloys of recently developed nickel and superior corrosion resistance should improve considerably the service performance of chromium plated aluminum alloys.

*Present address:
International Business Machines, Poughkeepsie, N. Y.

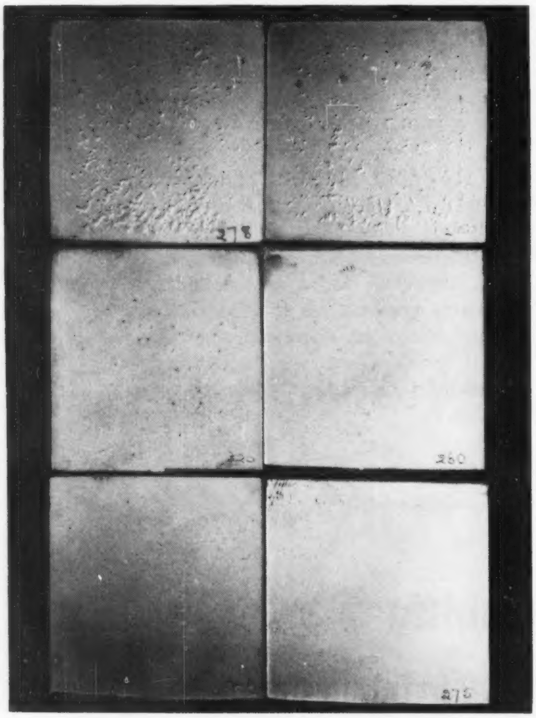


Fig. 1. Zincate process Cu/Ni/Cr plated 3S panels exposed in semi-rural atmosphere for 24 months: front surface. (Nominal nickel thickness [mil], top 0.5, center 1.0, bottom 1.5; zincating time [sec.], left 15, right 60. 0.6X).

Introduction

Bright "chrome" finish on aluminum has been of great interest for many years because of its bright, tarnish-resistant appearance and its value in assisting aluminum to compete with "chrome" applications on other metals, particularly in the automotive, hardware, and appliance fields. For maximum use it is necessary to obtain atmospheric exposure resistance equivalent to that on competitive base metal products. Such protection is provided by a nickel deposit of adequate thickness under the thin, top layer of bright decorative chromium.

A major problem in the plating of aluminum and its alloys has been the elimination of the surface oxide film so that direct bonding is secured between the substrate and the initial metal layer. Various methods have been developed to solve this problem. The three major preplating techniques have been the zincate treatment[1] in which a thin displacement zinc coating is formed by immersion in an alkaline sodium zincate solution, the Vogt process[2, 3, 4] which employs unusual cleaning methods followed by flash plating of zinc and brass deposits, and lastly anodizing treatments in phosphoric[5] or oxalic acid[6] prior to a possible modification of the anodic film by controlled dissolution and plating directly onto the highly porous film. The zincate process or one of its many modifications has been used widely for many years, the Vogt treatment has been employed almost entirely in Great Britain or Europe, while the phosphoric acid anodic technique has been restricted to specific applications in the United States.

A program to investigate various commercial methods of plating aluminum was initiated some years ago in this laboratory. All three preplating procedures were investigated. Panels of 3S sheet (AA3003) were prepared by various modifications of each process for laboratory tests. On the basis of the results obtained, additional panels were plated under selected conditions and placed on exposure outdoors. Preparation of panels by the phosphoric acid anodizing process and laboratory results obtained, have been briefly reported.[7]

The plating program was suspended because of the growing acceptance of "bright trim" (chemically brightened and anodized) finish and decreased interest

in bright chromium for aluminum. The results obtained in the uncompleted plating investigation are of interest because of the paucity of published information comparing these preplating and plating processes and outdoor behavior of coatings prepared by these techniques.

Experimental Procedure

(1) ALUMINUM PANELS:

The composition of the two lots of 0.032″ 3S sheet used in this work is shown in Table 1. Panels were 4″ x 4″ with a small "tag" of metal protruding above the liquid level for electrical contact during treatment, after which it was removed.

TABLE 1

Composition of 3S Aluminum Sheet (%)

Cu	*Fe*	*Mn*	*Si*	*Ti*	*Comments*
0.04	0.44	1.16	0.33	0.01	Mill finish
0.03	0.42	1.12	0.10	0.29	Bright finish used in Vogt series only

(2) PLATING PROCEDURES:

The plating procedures for the three processes are summarized briefly below. These processes differed not only in their pretreatment, but also in the initial type of deposit and subsequent plating conditions. The use of uniform plating conditions would have facilitated direct comparison of the processes, but this was not possible; the plating conditions chosen were those which had been found most promising in preliminary laboratory tests including exposure to 5% salt spray.

(a) *Zincate Process*:

Sets of copper (0.3 mil)/nickel/chromium (0.01 mil) plated panels were prepared for each of the six combinations of the following variables:

two zincate immersion time periods (15, 60 sec.)

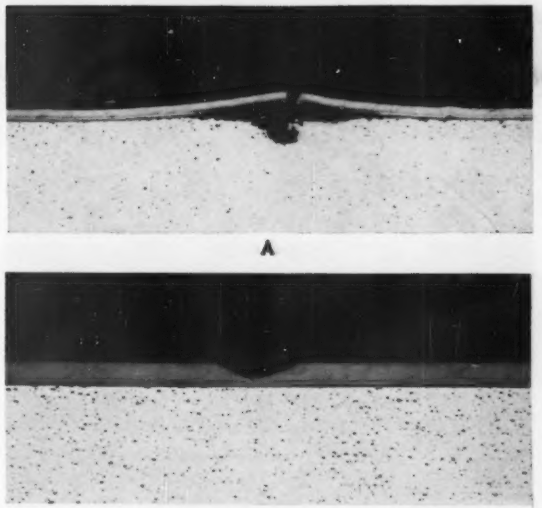
three nickel thicknesses (nominal 0.5, 1.0, 1.5 mils)

Panels were cleaned, etched in a hot sulphuric acid solution, dipped in nitric acid, immersed in the conventional alkaline sodium zincate solution (ZnO-100 g./l., NaOH-525 g./l., 25°C.) to form a thin zinc immersion coating, followed by a copper strike in a normal Rochelle bath, copper plating in a proprietary high-speed cyanide solution, bright nickel plating in a proprietary bath and chromium plating under the conventional bright plating conditions. (CrO_3-250 g./l., H_2SO_4-2.5 g./l., 45°C., 100 amp./ft.^{2}.)

(b) *Vogt Process*:

The standard Vogt process consists of electrolytic and acid etching cleaning procedures followed by plating zinc for 20 sec., brass for 10 sec. and nickel. The zinc and brass plating solutions are very dilute and of unusual composition.[2] The nickel is plated from a low-chloride solution, to yield a soft unstressed deposit. Heat treatment of the plated work is recommended (235°C., 30 min.), followed by buffing, cleaning and bright chromium plating.

Preliminary work had indicated the importance of the structure and thickness of the initial zinc film



A

B

Fig. 2. Pitting attack on zincate process Cu/Ni/Cr plated 3S panels exposed 24 months in semi-rural atmosphere. (Front surface; nominal nickel thickness [mil]; a, 0.5; b, 1.5. 90X).

and, therefore, several procedures were used to deposit this film. Five sets (A-E) of zinc/brass/nickel (1.0 mil)/bright chromium (0.01 mil) plated panels were prepared. These differed only in the zinc film formation conditions. Single zincating treatments included (A) electrodeposited (standard conditions) and (B) immersion (conventional sodium zincate solution, 30 sec., 25°C.) films. Double zincating procedures[4] consisted of stripping an immersion coating in nitric acid, followed by formation of a second zinc coating by (C) electrodeposition, or (D) immersion treatments (30 secs.). The fifth procedure (E) employed anodic stripping of an immersion film[9] followed by a second immersion treatment (30 secs.).

Three further sets of panels (F, G, H) were treated by the zincate process to determine the value of a double zincating procedure,[10] and were tested with the Vogt processed panels. These had a copper (0.3 mil)/nickel (1.0 mil)/bright chromium (0.015 mil) deposit. The initial zinc immersion film was stripped in nitric acid, followed by a second immersion treatment for periods of 30 (F), 10 (G) and 180 (H) seconds. Copper was deposited from a Rochelle bath, followed by nickel plating from the standard Watts solution, buffing, cleaning and bright chromium plating. All eight sets (A-H) included both heat-treated and non-heat-treated panels.

(c) *Phosphoric Acid Anodizing*:

Three sets of copper (0.4 mil)/nickel (0.5, 1.0, 1.5 mil)/chromium (0.01 mil) plated panels were prepared.[7] Panels were cleaned, alkaline etched and dipped in nitric acid, anodized in phosphoric acid (30% wt., 30°C., 10 min., 10 amp./ft.^{2}) and copper plated in a proprietary pyrophosphate bath. The work was acid treated and nickel plated in a standard Watts bath. The dull deposit was buffed, cleaned, and bright chromium plated. After copper plating, half the samples were forwarded to a commercial plating test

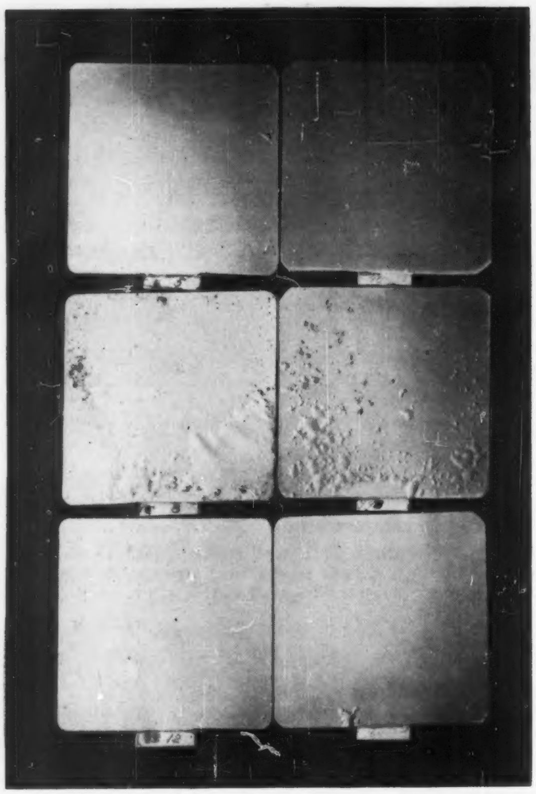


Fig. 3. Corrosion attack produced by winter exposure in an industrial atmosphere on Vogt and zincate process Ni/Cr plated 3S panels. (Left column, standard Vogt process [A] not heat-treated; right column, zincate [30 sec.] process [F] not heat-treated. Top row, exposed 8 months March-November period; center, 12 months; bottom, semi-rural exposure 12 months. 0.5X).

laboratory for nickel and chromium plating by the techniques listed. Some panels had the aluminum substrate exposed by cutting two V shaped grooves approximately 0.025 cm. deep diagonally from corner to corner.

(3) Atmospheric Exposure:

Panels prepared by all three procedures were exposed in semi-rural (Kingston) and severe industrial (Montreal) atmospheres* under standard exposure conditions. Single specimens were exposed with the zincate series but, otherwise, duplicate or triplicate panels were tested. Panels were returned after various periods for examination and retention although, in a few cases, they were re-exposed for a further period. The exposed panels were examined before and after cleaning. Defects at the tab and less than 0.25 in. from the edges were disregarded. In the case of the phosphoric acid anodized panels, the edges were lacquer coated. The various types of defects on cleaned panels were assessed by the A.S.T.M. rating system.[8] Large differences in weighting factors for various types of defects made some defects, e.g. blistering (factor of 2) more important than others, e.g. light surface pitting (factor of 0.01). Determination of the percentage surface area with each type of defect was simplified by use of a series of diagrams illustrating the number of defects of various sizes corresponding to each rating.[11] These diagrams were enlarged to 4″ x 4″ to permit direct comparison with the exposed panels and so facilitate estimation of the surface area of a specific type of defect. The appearance ratings reported are the averaged values.

After exposure, a few panels representative of all three preplating processes and different plating thicknesses were examined in cross-section by normal metallographic techniques, to determine the type and location of the corrosion attack during atmospheric exposure and the minimum thickness of the copper and nickel deposits. Chromium thickness was noted by normal procedure.[12]

*The SO_2 concentration of Montreal atmosphere from 1955-9, measured at an adjacent location, varied between a minimum of 1 unit (mg. SO_3/day/100cm.^{2}) in the summer to a maximum of 3-4 units in the winter. Values for Kingston are estimated as less than 0.2 units.

Experimental Results

(1) Zincate Process Plated Panels: Atmospheric Exposure:

The deteriorating effect of outdoor exposure was very severe under industrial and light under semi-rural atmospheric conditions. The sets of panels exposed in an industrial atmosphere (Montreal) except those with the heaviest nominal nickel (1.5 mils) thickness and the 15 sec. zincate treatment, had ratings of zero, due to severe blistering and flaking, after only 6 or 12 months outdoors. The panels exposed in Kingston's semi-rural atmosphere showed a much lighter attack. (Table 2.) After 24 months exposure (Fig. 1) the panels with 0.5 mil nickel thickness showed extensive small blisters but no general lifting of the film. The deposition of thicker nickel greatly increased the resistance to blister formation, e.g., the panels with 1.5 mils of nickel were virtually free of any blistering attack. No significant differences were noted between the 15 and 60 sec. zincated specimens. The ratings of the back surfaces (where attack is generally more severe than on the front) indicated slightly superior performance in favor of the 15 sec. zincated panels.

Considerable pitting attack, including widespread fine surface pitting, was detected on the panels with the thicker nickel coatings exposed in Kingston. This attack was free of staining. Pitting attack was not prominent on the 0.5 mil nickel panels, where extensive blistering had already occurred.

TABLE 2

Appearance Ratings of Zincate Processed Cu/Ni/Cr Plated 3S Panels After Exposure in Semi-Rural Atmosphere

Nominal Nickel Thickness (mil)	*Exposure Period* 12 Months, Zincate Treatment (sec.) 15	12 Months 60	24 Months, Zincate Treatment (sec.) 15	24 Months 60
0.5 front	9	8	1	2
back	(5)	(2)	(0)	(1)
1.0 front	9	9	6	7
back	(9)	(2)	(9)	(6)
1.5 front	9	9	8	9
back	(9)	(9)	(5)	(2)

Metallographic examination in cross-section of three panels with differing nickel thicknesses exposed in Kingston for 24 months illustrated the value of heavier coatings in reducing the severity of corrosion attack. Penetration of the copper/nickel/chromium deposit and attack on the aluminum substrate was found on both the front and back surfaces of the panel with the 0.5 mil nickel coating. Blistering between the coating and the substrate due to the buildup of aluminum corrosion products was prominent (Fig. 2a). On the panels with thicker nickel deposits no attack of the aluminum was noted on the front surface (Fig. 2b) and only minor attack with slight blistering on the back surface.

The results showed that the initial attack is by pitting, which proceeds steadily until penetration of the deposit takes place, followed by a "build-up" of local corrosion products, which may force the plated coating upwards and rupture the coating around the pit.

The corrosion attack on panels placed in the Montreal environment followed a much more severe and rapid pattern. Differences in climatic conditions from those at Kingston are not great enough to be the cause of this variation. This leaves as the probable cause the heavy accumulation of dust and grime and the increased concentration of industrial gases as compared to a very small amount of soil on the panels exposed at Kingston.

(2) Vogt Process Plated Panels:

(a) *Semi-Rural Atmosphere*:

The panels exposed in Kingston showed little change during the first six months and, in panels prepared by several procedures, only slight deterioration during a further six months of exposure (Table 3). A few small blisters were noted on some panels, in addition to general very fine surface pitting attack. Heat-treatment effects were small and inconsistent.

(b) *Industrial Atmosphere*:

All the panels, regardless of treatment, had failed badly before twelve months exposure in Montreal, as indicated by appearance ratings ranging from 0 to 1.6 with one isolated value of 4.2 (Table 3). Since all panels had a nominal nickel thickness of 1 mil, the degree to which thicker nickel would improve the corrosion resistance was not determined. There was appreciable and increasing attack during the initial eight months exposure over a March to November period. Ratings varied from 3.3 to 9.3, with an average value of about 5-6. During the next four months (November to March) the rate of attack was greatly accelerated by the winter weather. The severity of winter exposure in Canada and northern United States on plated coatings is well known, but the results noted were even more severe than expected. This effect is illustrated by Fig. 3, which compares the appearance for two treatments after eight and twelve months exposure in Montreal. As stated earlier, the rapid deterioration is due to industrial atmospheric contamination, since the panels exposed in a semi-rural atmosphere with equivalent weather conditions (Fig. 3) showed a different pattern and less severe attack.

Outdoor exposure produced blistering attack. Other effects, such as staining and fine pitting, were insignificant. Initial blisters were at a few scattered points and were small, but their size and frequency increased with continued exposure. In a few cases, lateral expansion was rapid, resulting in lifting of the plated coating from the surface over as much as 50-75% of the panel area. The results did not permit differentiation between the various procedures investigated. However, on the basis of the first eight months

TABLE 3

Appearance Ratings of Vogt Process Ni/Cr Plated 3S Panels During Outdoor Exposure for Twelve Months

	Preplating Modification	Heat-treated	Appearance Ratings (Averaged) Exposure Period (months) Semi-Rural 6	Semi-Rural 12	Industrial 4	Industrial 8	Industrial 12
A	Standard Vogt	No	10	9	8	6.1	1.2
	EZ*	Yes	10	—	5.4	4.8	0
B	Standard Vogt	No	9	6.3	7.9	5.2	0.2
	IZ*	Yes	9	5.5	7.2	6.0	0
C	Nitric Acid Strip	No	10	9	6.5	4.6	1.5
	EZ	Yes	9	9	1.5	4.2	0
D	Nitric Acid Strip	No	10	9	7	5.5	0.4
	IZ	Yes	9	7.2	4.7	4.8	0
E	Electrolytic Strip	No	9	6	7.4	4.1	0.9
	IZ	Yes	9	7.8	9	5.5	0
F	Zincate	No	9	6.5	7.7	9.3	0.7
	30 sec.	Yes	10	8.1	10	9	4.2
G	Zincate	No	10	9	10	7.2	1.6
	10 sec.	Yes	—	—	—	—	—
H	Zincate	No	—	—	9	3.3	0.6
	180 sec.	Yes	—	—	—	—	—

*EZ—electrodeposited zinc coating.
IZ—immersion zinc coating.

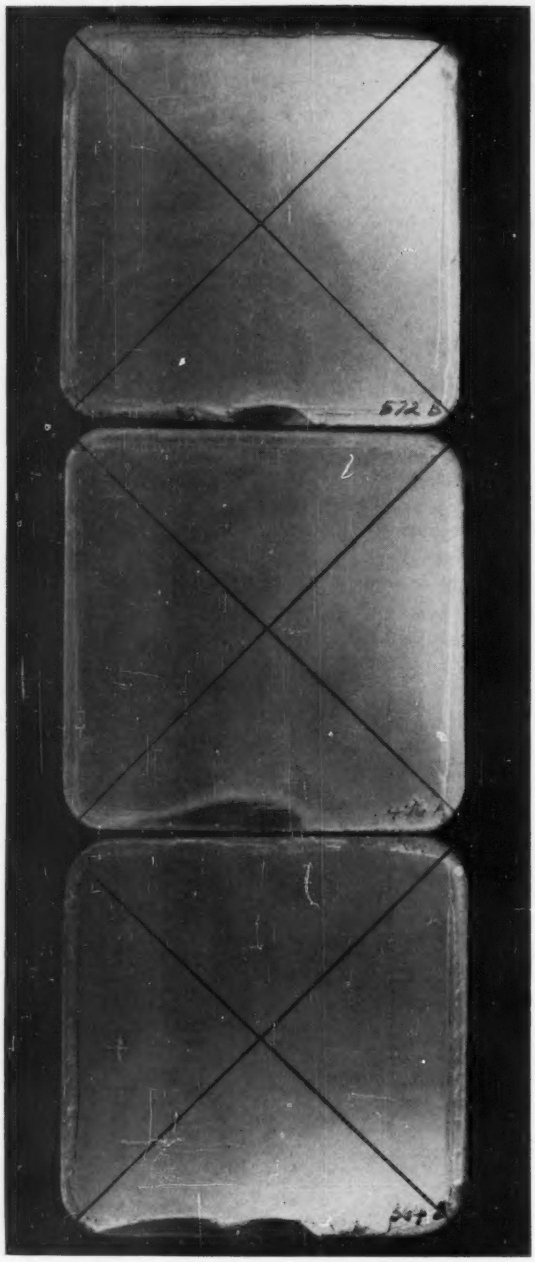


Fig. 4. Phosphoric acid anodized Cu/Ni/Cr plated 3S panels exposed in semi-rural atmosphere for 24 months: front surface (nominal nickel thickness [mils] top 0.5, center 1.0, bottom 1.5. 0.6X).

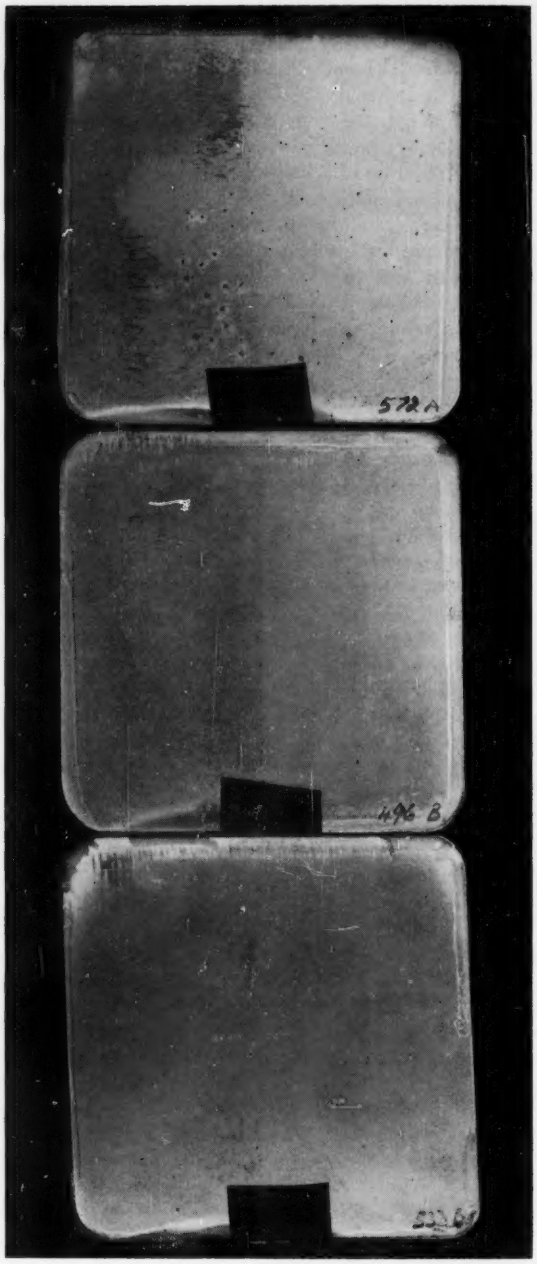


Fig. 5. Phosphoric acid anodized Cu/Ni/Cr plated 3S panels exposed in semi-rural atmosphere for 24 months: back surface (nominal nickel thickness [mils] top 0.5, center 1.0, bottom 1.5; left panel section shows staining. 0.6X).

results, the 10 and 30 seconds treatment by the normal zincate process yielded deposits superior to those produced by any of the Vogt type procedures. Zincating for prolonged periods of 180 seconds gave inferior results, thus, confirming previously reported results.[10] Heat treatment appeared to increase general blistering attack.

Metallographic examination of non-heat-treated panels prepared by the standard Vogt procedure (A) and exposed in Montreal for 4, 8 and 12 months revealed that the panel exposed for 4 months had suffered little or no attack. The panels exposed 8 and 12 months showed pitting penetration and appreciable corrosion of the aluminum, causing blister formation. The attack was much more severe on the back surfaces. Examination of similarly processed panels exposed 12 months under semi-rural conditions in Kingston revealed no pitting penetration of the coating on the front surfaces, although this had occurred on the back surfaces.

Similar investigation of three non-heat-treated panels processed by the zincate process for various times and exposed for 8 months in Montreal showed slightly less

(*Continued on page* 47)

Size Control of Plated Screws

By Martin Pollack, *Development Engineer, Sethco Mfg. Co., Merrick, L. I.*

THE three most important measurements of a screw thread in plating are:

1. Major Diameter: The largest diameter of a screw thread. The term "major diameter" applies to both internal and external threads and replaces the term "outside diameter" as applied to the thread of a screw, and also the term "full diameter" as applied to the thread of a nut.

2. Minor Diameter: The smallest diameter of a screw thread. The term "minor diameter" applies to both internal and external threads and replaces the term "core diameter" and "root diameter" as applied to the thread of a screw, and also the term "inside diameter" as applied to the thread of a nut.

3. Pitch Diameter: The diameter of an imaginary cylinder the surface of which would pass through the threads at such points as to make equal the width of the threads and the width of the spaces cut by the surface of the cylinder. Referring to the American Standard Vee thread, the Pitch or Effective Diameter may be defined (on a perfect thread) as that point where the width of the thread and of the groove are equal.

Series of threads are classified and distinguished from each other by the number of threads per inch applied to a specific diameter and are designated as Standard or Special. Six standard series of threads are included in the United and American Screw Threads standard ASA B1.1-1949. Following are the two series most important in plating.

1. Coarse-Thread Series: The Coarse Thread Series designated as "UNC" and "NC" is the former "United States Standard." It is recommended for general use in engineering work where conditions do not require the use of a fine thread.

2. Fine-Thread Series: The Fine Thread Series designated as "UNF" and "NF" is the former "Regular Screw Thread Series," established by the SAE in 1911. It is recommended for general use in automotive and aircraft work, and where special conditions require a fine thread.

Screw thread standards in the United States, Canada, and Great Britain were unified through prolonged joint efforts which culminated in the signing of a declaration of accord in 1948. The Unified and American Screw Threads Standard (ASA B1.1-1949) is similar to the American National Standard formerly used in the United States. Thread angle (60°) and depth of V thread are identical, as is the truncation (n/8) at the major diameter. Basic pitch diameters, therefore, are identical for the same diameter and pitch. Threads made to old and new standards are interchangeable.

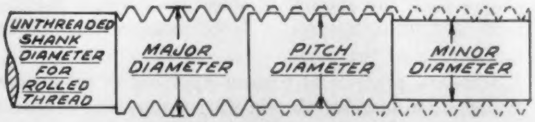


Fig. 1. External Thread (Screw).

The Unified standards also provide a minimum clearance between mating threads, preventing tight fits or seizure and allowing room for plating. In all cases, the unified or new American Standards can be assembled with the old American threads. Where Class 2 or Class 3 of the old American Standard tolerances are specified, the new Class 2A and 2B parts which are the recognized standards for the normal production of bolts, screws and nuts will assemble.

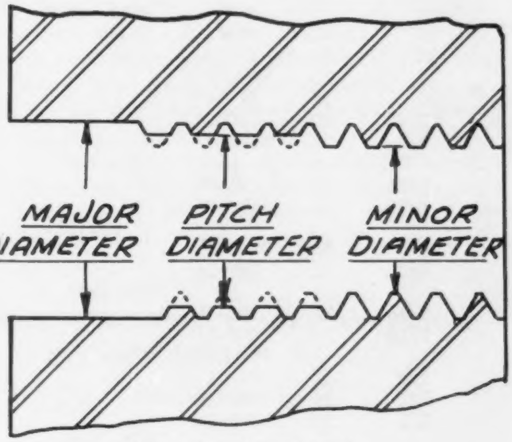


Fig. 2. Internal Thread (Nut).

Classes of thread are distinguished from each other by the amounts of tolerance and allowance specified. The Unified Screw Threads are limited to Classes 1A, 2A and 3A, applied to external threads and 1B, 2B, 3B applied to internal threads. Class 2A external threads, and Class 2B internal threads are the recognized standards for the normal production of screws, bolts and nuts. Class 2A maximum dimensions are less than basic by the amount of an allowance. The main purpose of this allowance is to provide a minimum clearance between external and internal threads. It supplies a space to take care of plating applied to external threads and to minimize galling and seizure encountered in assembly. Plated parts are intended to be gauged with basic-size "go" gauges.

Parts are gauged to secure interchangeability and

Table of Surface Areas of Machine Screws

SURFACE AREAS OF MACHINE SCREWS

	DESIGNATION					SURFACE AREAS		
Size	Threads per Inch	Thread Symbol	Fraction Diam. & Dec. Equivalent	Max. Major Diam.	Unthreaded Area/Inch Sq. In.	Threaded Area/Inch Sq. In.	Round Head Sq. In.	Flat Head Sq. In.
0	80	NF-2A		0.0595		.286	.028	.023
			1/16-.0625		.1963			
1	72	NF-2A		0.0724		.352	.042	.036
2	56	NC-2A		0.0854		.427	.061	.051
2	64	NF-2A		0.0854		.434	.061	.051
3	48	NC-2A		0.0983		.469	.080	.066
3	56	NF-2A		0.0983		.483	.080	.066
4	40	NC-2A		0.1112		.528	.100	.089
4	48	NF-2A		0.1113		.547	.100	.089
5	40	NC-2A		0.1242		.599	.125	.108
5	44	NF-2A		0.1243		.606	.125	.108
			1/8-.125		.3927			
6	32	NC-2A		0.1372		.646	.154	.138
6	40	NF-2A		0.1372		.680	.154	.138
8	32	NC-2A		0.1631		.788	.219	.198
8	36	NF-2A		0.1632		.800	.219	.198
			3/16-.1875		.5890			
10	24	NC-2A		0.1890		.897	.291	.270
10	32	NF-2A		0.1891		.934	.291	.270
12	24	NC-2A		0.2150		1.037	.377	.350
12	28	NF-2A		0.2150		1.058	.377	.350
1/4	20	UNC-2A		0.2489		1.200	.500	.47
1/4	28	UNF-2A		0.2490		1.245	.500	.47
			1/4-.250		.7854			
5/16	18	UNC-2A		0.3113		1.52	.78	.76
5/16	24	UNF-2A		0.3114		1.58	.78	.76
			5/16-.3125		.9817			
3/8	16	UNC-2A		0.3737		1.84	.92	.91
3/8	24	UNF-2A		0.3739		1.91	.92	.91
			3/8-.375		1.1781			
7/16	14	UNC-2A		0.4361		2.15	1.04	
7/16	20	UNF-2A		0.4362		2.23	1.04	
			7/16-.4375		1.3744			
1/2	13	NC-2A		0.4985		2.48		
1/2	15	UNC-2A		0.4985		2.52		
1/2	20	UNF-2A		0.4987		2.57		
			1/2-.500		1.5708			
9/16	12	UNC-2A		0.5609				
9/16	18	UNF-2A		0.5611				
			9/16-.5625		1.7671			
5/8	11	UNC-2A		0.6234				
5/8	18	UNF-2A		0.6236				
			5/8-.6250		1.9635			
3/4	10	UNC-2A		0.7482		3.81		
3/4	16	UNF-2A		0.7485		3.89		
			3/4-.750		2.3562			
7/8	9	UNC-2A		0.8731				
7/8	14	UNF-2A		0.8734				
			7/8-.8750		2.749			
1	8	UNC-2A		0.9980				
1	14	UNF-2A				6.08		
			1.00		3.142			

to insure dimensional conformation within the limits of the tightest and loosest conditions of fit permissible. This is usually accomplished by using plug and ring thread gauges. Maximum metal limit gauges, known generally as "go" gauges, control the minimum looseness or maximum tightness in the fit of mating parts and, accordingly, control interchangeability. Minimum metal limit gauges, known generally as "not go" gauges limit the amount of looseness between mating parts and, thus, control in large measure the proper functioning of the parts.

Standard practice at present applying to 60 degree threads is to increase the Go Plug Gauge and *decrease* the Go Ring Gauge 4 times the thickness of the maxi-

mum plate and to increase the No Go Plug Gauge and decrease the No Go Ring Gauge 4 times the thickness of the *minimum plate.*

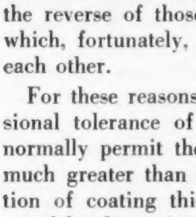
Consider an external screw-thread after plating. It is safe to say that, generally speaking, the deposit on the outside diameter will be slightly heavier than that on the root diameter, while that at the pitch diameter will be between the two extremes. Theoretically speaking, this will change the 60° angle very slightly; but, for practical purposes, we think it insignificant. Again, a deposit 0.0001″ thick on the outside diameter obviously will increase the original size by 0.0002″, since the deposit is all around, and the increase is proportional to the thickness of the deposit. This will also be true of the deposit at the root diameter. However, it is a totally different story when it comes to the measurement of the deposit at the pitch diameter. This, it will be recalled, is on the wall or flank of the thread and, while the deposit may have a true thickness of 0.0001″, nevertheless, when measured over the diameter, it will increase the original size by 0.0004″. In other words, the increase in pitch diameter (usually measured by the three wire system) will be equal to four times the thickness of the actual deposit on the wall of the thread. (See Fig. 3 & 4.)

With an internal thread or nut, it is safe to say that the deposit at the *root* diameter will be slightly heavier than that at the *major* diameter, and at the *pitch* diameter it will be between these two extremes. This means that the high and low thickness areas are the reverse of those on an externally threaded part, which, fortunately, helps plated bolts and nuts to fit each other.

For these reasons, A.S.T.M. states that "the dimensional tolerance of most threaded articles does not normally permit the application of coating thickness much greater than 0.00015″ (0.15 mil). The limitation of coating thickness on threaded fasteners imposed by dimensional tolerances should be considered both by the plater and his customer to prevent the application of greater coating thicknesses than are generally permissible. If heavier coatings are required for satisfactory corrosion resistance, allowances must be made in the manufacture of the threaded fasteners for the tolerance necessary for plate "build-up."

The general procedure which has been discussed should be followed for each part which is being plated. At first thought, this may appear complicated but, actually, all one needs to do is to check thicknesses, watch size of loads and time of plating, and keep the equipment and the plating solution in condition so that the current and barrel efficiency are maintained.

The necessary primary data on standard screws



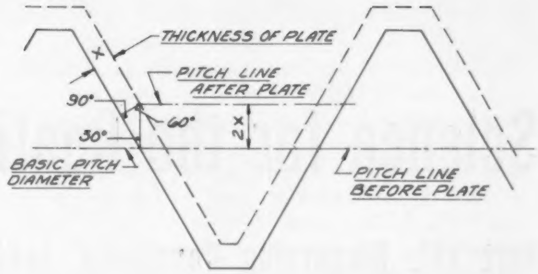
EXAMPLE OF HOW PLATING ON A SCREW THREAD CHANGES THE PITCH DIAMETER FOUR TIMES THE THICKNESS OF PLATING.

AN EQUILATERAL TRIANGLE HAS THREE EQUAL ANGLES. (60°)

BISECTING ONE ANGLE ALSO BISECTS THE SIDE OPPOSITE, AND FORMS TWO 30°-60° RIGHT TRIANGLES.

THE HYPOTENUSE OF A 30°-60° RIGHT TRIANGLE IS ALWAYS TWICE THE BASE.

Fig. 3.



THE PITCH LINE IS CHANGED BY TWICE THE THICKNESS OF PLATING. THEREFORE, THE PITCH DIAMETER OF THE SCREW IS INCREASED FOUR TIMES THE THICKNESS OF PLATING.

THE PITCH DIAMETER OF THE NUT IS REDUCED FOUR TIMES THE THICKNESS OF PLATING.

Fig. 4.

occur in National Bureau of Standards Handbook H28, "Screw Thread Standards for Federal Services." The table may be used to calculate the surface area of standard machine screws employing the formula:

Total S.A. = Area of Head + Area of Threaded Portion + Area of Unthreaded Portion.

In this table please note the following:

1. These Head Areas *include* the circular area at the end of the shank (equivalent to the area of intersection of the shank with the head).
2. Screws up to $\frac{3}{4}$″ long are threaded full length.
3. Screws $\frac{3}{4}$″ to $1\frac{1}{2}$″ long inclusive are threaded $1\frac{1}{16}$″ minimum.
4. Screws over $1\frac{1}{2}$″ are threaded $1\frac{1}{4}$″ minimum.

NICKEL-CHROMIUM PLATED ALUMINUM SHEETS

(Continued from page 44)

pitting and corrosive attack on panels zincated for 10 sec. than on the panels processed for longer periods.

(3) Phosphoric Acid Anodized Plated Panels:

(a) *Semi-Rural Atmosphere*:

A set of 14 panels exposed for 24 months in Kingston were, with one exception, completely free of blistering. There was some very fine surface pitting attack, but this had caused little or no change in their appearance (ratings varied from 9.7 to 9.9). No significant attack was noted on the grooved panels along or adjacent to exposed aluminum (Fig. 4).

The sheltered back surfaces of the panels (Fig. 5) showed an appreciable degree of attack, providing a sharp contrast to the unchanged, boldly exposed front surfaces. Pitting penetration of the coating and brown colored staining were appreciable on the panels, but to a much smaller extent on the panels with the thicker (1.5 mil) nickel deposit. No blistering, however, was noted on any panels except that on the one panel with blistering on its front surface. The averaged ratings on the back surfaces were 4.3, 4.9 and 8.6 for the three groups with nominal nickel coating thickness of 0.5, 1.0 and 1.5 mils respectively.

(To be continued)

Science for the Coatings Technologist

Part XVI. Dispersion Continued: Individual Mills.

By E. S. Beck

This is the second and concluding installment of Part XVI. The first installment appeared in the November issue of Metal Finishing.—*Ed.*

Theory of Closed Mill Performance

WE are now at the point where we can tie in the various facts we have discussed with a theory of mill performance. This will also enable us to review a number of the most important factors.

Most students of ball mill grinding are agreed that there is a variety of different actions taking place in the mill. Pearce[3] considers grinding (actual reduction in particle size) to be accomplished by the cascading action of the balls. Thus, the balls closest to the shell of the mill are carried to the top by frictional action while the mill rotates. These then fall in the cascade, striking the balls at the bottom of the mill. The freedom with which the cascading balls can fall is governed partly by the viscosity of the paste and partly by the volume of paste in the mill.

Thus, in formulations where some actual grinding is to be accomplished, lower viscosities and lower charges of paste will promote faster and better grinding action, by allowing increased cascading. The cascading action also contributes a definite share of the shearing stresses of the milling operation as well, so it is valuable on both counts. If the mill is loaded much above 50% of its total capacity, cascading is greatly interfered with. This is the principal reason why control must be exercised over the volume of the charge in the mill.

Pearce also refers to an attrition action by a portion of the balls which move in a definite pattern, but do not cascade. These balls contribute shearing action, promoting both wetting and dispersion. This shearing force is too weak to be of much value in reduction of pigment particle size.

Daniels[4] also recognizes the dual action of ball mills and feels that the emphasis on actual particle size reduction is no longer so insignificant. This is because the overwhelming majority of present-day pigments are manufactured in small enough particle size so that no actual reduction in particle size is required. The actual function of present-day grinding (except in the limited number of cases where coarse pigments are being used) is to break apart, wet, and disperse flocculates or agglomerates (clusters) back into the original primary particles. This is best accomplished by relatively weak forces, such as inter-pigment particle rubbing (shear).

Daniels continues with the following statements, which deserve to be quoted:

"In the minds of most paint men closed mills are associated with the strong impact forces and the size reduction of the hardest pigments. Under certain conditions, however, the shear component, although a much weaker force, can be made to contribute many times as much 'grinding' work as the impact. If so used, the ball and pebble mills will turn out much more paint, and of a higher quality, than if used primarily as an impact tool.

"It can be shown that the shearing action in the ball mill becomes the dominant dispersing force when the pigment and inert concentration is high and at the same time the viscosity of the grinding vehicle is low.

"When both of these conditions are fulfilled, the flocculates and particles rub against each other most effectively and most frequently and thus cause wetting and dispersion in the shortest possible time."

Other Factors of Closed Mill Operation

We have already mentioned the high efficiency and low cost of these mills. For economy, there is no other mill which can approach them. The reason for this is the relatively low labor requirement. Other mills require the constant attendance of an operator. Ball mills, once loaded, require no further attention until they are unloaded.

This, coupled with the high pigment capacity which they display, makes them the lowest-cost machines for pigment dispersion in terms of finished gallons of paint per dollar of cost.

This alone explains their widespread use. They are, also, the only commonly used machine which will reduce particle size of coarse, hard pigments.

The Kady Mill

The Kady mill is one of the newer machines to be adopted by paint manufacturers. It is simple in its concept and in its construction. There is only one

moving part, a rotor, at the bottom of a smooth tank with a flat bottom and lid. The rotor is surrounded by a stator, against which the particles of paste strike.

The dispersion enters through a bottom feeding propeller, goes into the rotor, and is given a very high acceleration. It is allowed to escape through slits in the rotor into corresponding slits in the stator. The impact. In processes which depend upon shearing, in a short order, despite the very small period of time any portion of the paste is exposed to the actual milling action of the machine.

Unlike the ball or pebble mill, there is very little shearing action in the operation of the Kady mill. The dispersing activity is the result of attrition and impact. In processes which depend upon shearing, a vehicle of high viscosity must be used to transmit the shear between the mill and the pigment particles. The drawback of high viscosity vehicles is that the pigment particles will tend to aggregate during the wetting process, making much extra work for the dispersing operation.

In the Kady mill, since there are only the forces of attribution and impact, low viscosity vehicles can be employed for preparing the dispersion. In this way rapid wetting without so much aggregation can be obtained.

In the normal operation of the machine, the liquids in the formula are added to the mill first, then the pigments are gradually added, and the batch is run for the predetermined time, or until the specified degree of dispersion is obtained. The mill can thus be operated without the need for any premixing operation.

The finished batches can be produced in quite rapid time. Many materials can be brought to a grind of 4 or 5 within twenty or twenty-five minutes. Pastes calling for grinds of 6 or better can be prepared in 60 to 120 minutes, with such pigments as toluidine red or chrome green. This is quite an acceptable output, for it means that batches of paste of 75 or 160 gallons, corresponding to yields of finished paint of as high as 200 to 400 gallons (depending on the size of the Kady mill) can be made in less than two hours.

Output rates as high as 200 gallons an hour for gloss enamels are very high and make this one of the fastest mills available. Perhaps only the sand mill can equal these rates. A 1000-gal. pebble mill, turning out 300 gallons a day of white paste, yielding around 800 gals. of finished enamel produces only 33 gallons an hour.

The Kady mill requires relatively little attention during operation. It essentially requires only loading and unloading. There are no settings or adjustments to be made. Cleaning up is fairly simple as the unit is easily flushed clean, and the tank is smooth and free of obstructions to cleaning out.

For still higher output, premixers can be used. Slurry or slush premixes can be prepared in ordinary mixers, and then into the Kady mill. While the premixes are being prepared, the previous mix can be ground in the mill. In this way increases in output of as much as 40% may be obtained.

There is little metal contamination in this mill, and whites can be produced with no discoloration. All colors can be produced, and a wide variety of vehicles have given successful results.

Dispersions are usually produced in high pigment-low vehicle state, quite liable to flocculation, so it is good policy to reduce with additional vehicle as soon as the dispersion has been prepared.

No machine is perfect, however, and the Kady mill can be expected to have its weaknesses. It may be considered as a good high speed mill of great simplicity of operation. It can be used on a great variety of products. But it is better with certain pigments than with others.

Blacks, blues and other hard-to-disperse pigments present some problems to the Kady mill. These can be made, but if the best dispersion and gloss is wanted, trouble may be experienced in obtaining this in a reasonable time. Extender dispersions of a high degree of fineness, such as is required for flattening industrial baking enamels, are also not easily prepared.

With this mill, as with all the others, experience indicates those dispersions which are best prepared on it and others which are more suitable for some other machine.

Stone Mills

Stone mills are obsolete in the paint industry today. They were once the principal means of producing paint, and the stone has become the symbol of the paint industry, as used by the Federation of Paint and Varnish Production Clubs.

This mill grinds exceedingly slow, but not extremely fine, so its utility is low in both principal respects. The mill in essence consists of one large, disc-shaped stone rotating upon another of similar shape. Channels are cut into the stone to allow the entrance and egress of the paste. The paste during its progress between the stones is exposed to the grinding and shearing action produced by the movement of the stones. The finished paste slowly drains out of the opening via a funnel.

Batteries of stone mills were generally used to obtain some volume of output. Maintenance was a problem as the stones needed frequent dressing or carving back into shape. The dressing could be done only by an experienced operator. The general operation and adjustment of the mills was also rather difficult and specialized.

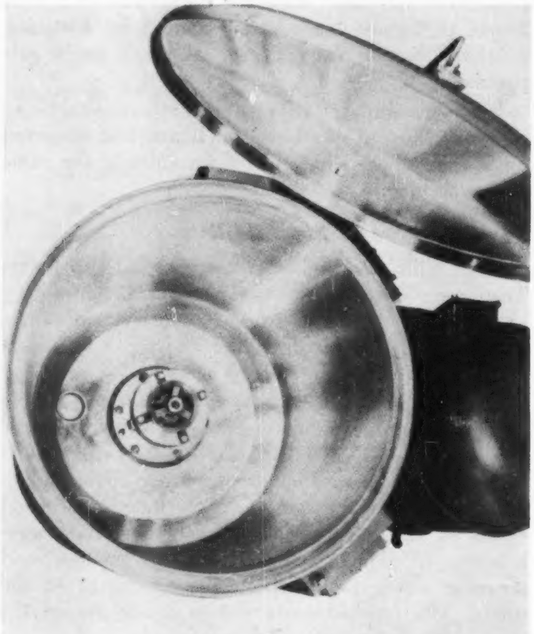
High Speed Stone Mills

These mills, first cousins of the old stone mills, are not obsolete in any way. In fact, they are rather one of the newer types. They are very widely used in the paint industry, principally in shelf goods or architectural applications.

Again we have two stones: But now the stones are very small in comparison to the old stone mills. They are mounted in the center of a tubular machine. The rotation is now at an extremely high rate instead of the very slow revolution of the original stone mill. The lower stone rotates, while the upper one is stationary. Rates of speed as high as 10,000 feet per minute (peripheral) are achieved. Actual r.p.m. of the machine is 3600.

The paste flows between the stones and may be pumped through or may flow by gravity. The distance between the stones is adjustable and there are a variety of stones of different grit size which may be used.

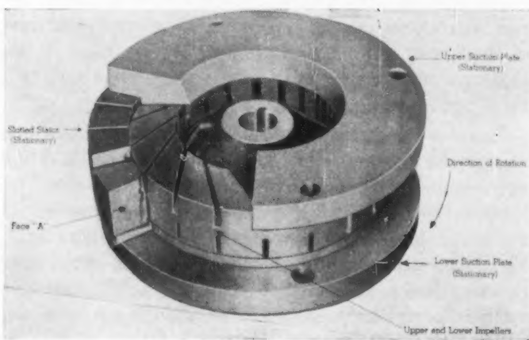
As might be expected, there is a great deal of heat generated during the operation of this mill. It is the hottest-running mill of those commonly used in the paint industry. Temperatures of 185 degrees F have been measured in the vapor of the thinners at the exit point from the stones. This corresponds to about 130 degrees F in the delivery chute.[7] Operating temperatures this high call for selection of high-boiling solvents. Vehicles or pigments which are sensitive to heat cannot be properly handled by this mill.



(Courtesy of Kinetic Dispersion Corp.)

Fig. 3a (above) shows interior view of the Kady mill and lid. The dispersion unit is at the bottom. The discharge valve is also at the bottom.

Fig. 3b (below) is a cut-away view of the work head of the Kady mill. The impellers shown here are a special purpose design, but similar in principle and operation to the standard impellers. The dispersion is flung with great force through the inner ring against the channels in the stator. Ultimately, the terrific erosive force of the paste causes wear along face "A".



(Courtesy of Kinetic Dispersion Corp.)

The mill is equipped with water cooling, which helps somewhat, but the process of grinding on the high-speed stone mill remains a high temperature operation.

The grinds obtained by the use of this mill commonly fall in the range of 1 to 4 on the Hegman gauge. This makes the mill very suitable for the production of house paints, traffic paints, and structural primers (red lead must be avoided as it can produce flash fires because of the high temperature of milling).

The output of the mill is quite rapid, and very good production rates are obtained. In many factories, a pair of mixers is used to feed one high-speed stone mill, so fast is the grinding process.

It is also possible to produce very high quality dispersions by means of the high-speed stone mill. This is not an easy process, however, Great care must be given to the paste composition, the pre-mixing, the setting of the stones, the grit of the stones, etc. Proper choice of dispersing aids is also important. With the softer, easier-dispersed pigments, such as titanium dioxide, good results can be obtained under practical conditions of commercial operation.

With harder-to-disperse pigments, closer stone settings are required, giving lower output, and losing some of the advantage of the speed of the mill.

Nonetheless, as reported by the C.D.I.C. Club[8] outputs of finely ground enamel (7½ Production Club or 6 N.S. or Hegman) were shown to be commercially obtainable. Examples were TT-E-489 (color not given) at a rate of 400 gallons per hour; TT-E-485b (despite the red lead content) at 250 gallons per hour, but at a grind of only 5 to 6 Production Club (4½ Hegman) which is not very good; and some others.

The CDIC Club emphasizes that high viscosity of the paste is most important, as it is required to get the necessary shear. They also point out that the use of wetting agent improves the grind by one or two points on the Production Club scale.

Anyone who has watched a high-speed stone mill in operation will form the impression that it is operating at a very high temperature. This is because one sees clouds of steamy vapor coming from the output chute of the machine. It looks as if the solvents in the paste going through the machine are actually boiling away in order to produce so much vapor.

While the machine actually does run hot, it has nonetheless been shown that the mist of solvent vapor is the result of throwing off thinner in droplets by the high rotational speed of the stones. The CDIC Club[8] states that volatile loss is actually less than with the three-roll mill. The spray mist of solvent can be seen even when the mill is running at room temperature.

The optimum running temperature is stated to be 120 to 135 degrees F, the optimum viscosity for the paste 120-140 K.U., and the optimum vehicle solids around 20%. However, with blacks and organic pigments, vehicle solids of 50% and higher are necessary, giving much slower rates of production.

While high grade enamel production is undoubtedly possible on the high-speed stone mill, it remains uncommon, because of the complexity and operating

limitations of the process. For materials needing a lower degree of dispersion it is an extremely widely used and valuable mill.

The weight of the machine is low, as is its cost. The output rate is very high with the proper types of material. The premixing operation is very important with this mill. This is because the paste goes through the mill so rapidly, and the grinding area between the stones (some 38 square inches in a commonly-used model) is so small. The forces are not sufficiently great to break up large pigment clusters so this must be done by means of the premix if even a medium quality dispersion is required.

Roller Mills

The roller mill is perhaps the most flexible and widely-useful of all the standard milling devices. It is quickly cleaned, so that it can be changed from one color to another with a minimum of wasted time. More important, it is useful on batches of all sizes, from very small to very large. Its value, however, against the closed mills declines as the batch size goes up, because of the economy of ball mills for large batches.

It is a machine which requires a certain amount of skill to operate. There are adjustments to be made at the beginning of the batch, and the output must be continuously checked to see that the degree of dispersion is being maintained. Further operating adjustments may be needed from time to time. In many factories, a mill operator remains on the mill during the entire time the mill is in operation. In other plants, one operator may run two mills, or in rare cases, even more.

The machines are large, rather expensive, and consume much power. The cost of roller mill dispersion can run rather high, when the labor, power, machine costs, and maintenance are all considered. In fact, this type of dispersion is one of the most expensive in the paint industry. Because of the high cost, many new machines and processes have been developed.

Why then, does the roller mill remain a widely-used dispersion device? First, its advantages over other types of mills in flexibility of batch size and ease of cleaning-up are outstanding. Batches of 5 gals. to 100 gals. can be rapidly turned out on the appropriate sized roller mill. If these amounts are needed quickly, there is no other commonly-used mill which can turn them out so rapidly. Three or four hours is all that is usually needed from premix through grinding.

Second, good gloss and stability of paste are obtained on the roller mill. Better, in fact, than on almost any of the other types of mills except kneaders, which also operate at high paste viscosities. The high vehicle solids which are used in roller mill pastes insure very good freedom from flocculation on letting back into enamels, as well as good stability of the paste during storage.

Plants which operate upon the system of bases, that is, using stock dispersions for preparing enamels, find the roller mill especially useful because of the stability of its pastes.

The roller mill itself consists of a series of long,

(Courtesy of Hy-R-Speed, Inc.)

Fig. 4. The high-speed stone mill in operation. Note the relatively small size of the mill. While not fully portable, the mill is easily moved from one place to another. It gives a large output in reference to its small size.

chilled steel cylinders lying in contact with each other. The three-roll mill, as the name indicates, uses three such cylinders, and is the more common type. In the three-roll mill, the three cylinders lie in the same plane. The five-roll mill, the other type, has the rollers touching each other, but to save space uses two planes.

As the paste moves from roll to roll it receives a mashing and shearing action from the rolls. This is obtained in three distinct ways. First, and most important, the direction of rotation changes with each roll. In the case of the three-roll mill, the back roller and the center roller rotate toward each other, while the front roller rotates away from the center roller. By this differential motion, a good shearing action is obtained.

Secondly, the speed of the rollers increases from back to front. The back, or take-up roller feeds the center roller, and rotates slowly. The center roller, between whose two contacting faces the actual dispersion takes place, moves faster, and the front roller the fastest of all. Different manufacturers use different speeds. The speed often varies from size to size. A typical speed figure for small roller mills is 1:3:9, as 33 rpm for the back roller, 100 rpm for the center roller and 300 rpm for the front roller. This speed variation also contributes much to the shearing action of the rolls. The roll speeds are fixed and can not be varied by the user.

The third factor in producing roller mill dispersion is the setting of the rolls. The distance between the

rolls controls to an extent the fineness of grind which is obtained. The setting is variable, and is adjusted by the operator. The setting values generally run between 1 and 2 thousandths of an inch. The space between the back and the center roller is usually set a little wider than that between the center and the front rolls.

The spacing must be uniform along the entire length of the two rolls in contact with each other. If not, big particles will get through wider spaces and spoil the cleanliness of the grind. Rollers show some tendency to warp and to wear unequally, so much care in the use and maintenance of these mills is necessary. Coarse, hard pigments should not be ground on the roller mill, as these remove the hardened, polished surface of the rollers.

At intervals, depending on the care and use of the mill, the rolls must be removed and be turned down on a lathe to complete uniformity and smoothness once more.

Experienced operators can tell when the mill is in best operating condition by observing the rollers and the paste output. The center roller should be almost clean, with an extremely thin film of the paste being ground on its surface. The appearance of the roller should be uniform along its length. Change in color or depth from one end of the roller to the other indicate a wedge-shaped spacing between the rolls, which is undesirable. Irregular variations along the length indicate that the rolls may be out of true.

The paste is removed from the front roller by an apron which is in contact with the roller via a knife edge. This contact must also be close and accurate, or poor results will be obtained. The roll should be scraped almost completely clean as it goes over the knife, or the same portion of paste will be ground over and over, with low output from the mill.

Over the years, a number of improvements have been made in the roller mill. While many mills are made with four adjusting wheels, which are not easy to handle for a beginner, hydraulic controls are available which make one-spot or two-spot control easy.

The delicate matter of roll-spacing has also been simplified by the so-called floating roll arrangement. The center roll is not mounted against the front and back rolls as in the conventional mill, but is essentially free-floating, so it can find its own adjustment. So long as the rolls are in reasonable condition as regards freedom from taper or other dimensional changes, this process is most satisfactory. It is relatively simple in operation and gives good, trouble-free results.

The roller mill requires a premixing, which is an extra operation, of course. As pointed out earlier, it is essential to obtain a good premixing if the best grinding results are wanted.

Roller mill pastes must be tacky so that they can stick to the rolls. If this property is lacking, it is almost impossible to obtain a decent grinding on the roller mill. In many cases, a non-tacky paste can be converted to a tacky one by the addition of a small quantity of a proprietary material. One commonly used is a rubbery material which imparts tack on the rollers and seems to introduce few if any undesirable properties.

The rollers are water jacketed in order that coolant may be circulated through them during the grinding operation. As the rolls can develop a rather high temperature during use, it is important to keep them cooled.

A certain hazard exists in the use of roller mills. Experienced men respect the mill, and are careful when operating it. Yet most plants can show an individual who has been injured or even lost a finger on the roller mill. The dangerous point is between the back and the center rolls, as these rotate towards each other.

Mention was made earlier of the five roll mill. The invention and adoption of this mill came about because the three-roll mill most often requires more than one pass of the paste over the mill. Two passes is frequent, while in some cases as many as five passes are required. By using five instead of three rolls, the paste receives the equivalent of two passes in one milling operation. While some paint manufacturers use five-roll mills, in general these mills have not caught on, and, indeed, are not considered as much superior to the three roll mill.

Baker and Vozzella[5] in a valuable study of the roller mill point out a number of interesting facts. Most valuable was the demonstration that the efficiency of roller mills increased as the resin solids content of the paste was increased. Maximum efficiency was obtained by the use of a 70% solids varnish without added thinner. As thinner was added to pastes, the consistency and tack was reduced, with a reduction in the milling efficiency. Lower vehicle solids in the pastes gave lower grinding efficiencies. In these respects, the roller mill is the reverse of the closed mill.

The roller mill is best used for soft pigments, or those easy to disperse, although it does an excellent job on carbon black. It is inefficient if used on hard, sharp, coarse pigments or those which must be broken down in size. For these materials, the ball or pebble mill represent the best choice.

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Electrodeposition of Nickel-Cobalt Alloys

Russian Research and Development

By A. J. Steiger

RUSSIAN engineers investigating electrodeposition of nickel-cobalt alloys have proved the expediency of using separate nickel and cobalt anodes in developing thick (3 to 4 mm) nickel-cobalt deposits of constant composition, according to a recent report published in Moscow's metal finishing trade press.

The finish hardness of nickel-cobalt deposits rises with the increase of cobalt content to 40% and remains practically constant thereafter, stated the report which was published in the Russian-language journal *Vestnik Maschinostroenie* (Machine-Building Herald) and gave details on the intensive Russian research and development work in this field.

The microstructure of the nickel-cobalt deposits, the journal said, is characterized by dendrites and the presence of wide and narrow bands, parallel to the deposition surface. Noting that Anglo-Scandinavian firms have patented a process for nickel-cobalt codeposition in the manufacture of nickel-cobalt alloy molds used in forming and casting plastic materials, the Russian report stated that the process was a great advance over engraving of press-molds, some of which take a year and more to make if done mechanically by skilled engravers. Information, however, is wanting on the electrolyte composition and the electrolysis conditions of the Anglo-Scandinavian process, the Russian journal said.

Russian research was therefore launched to develop joint electrodeposition of nickel and cobalt from sulfuric acid solutions and elucidate the problems of a galvanoplastic process to produce deposits of a nickel-cobalt alloy, the report went on. The series of experiments carried out has established the dependence between the relative concentrations of nickel and cobalt salts, and also the composition of the nickel-cobalt cathode deposits at various current densities. Also studied was the effect of pH and agitation on the composition of the nickel-cobalt deposits.

Experimental

An installation providing a continuous around-the-

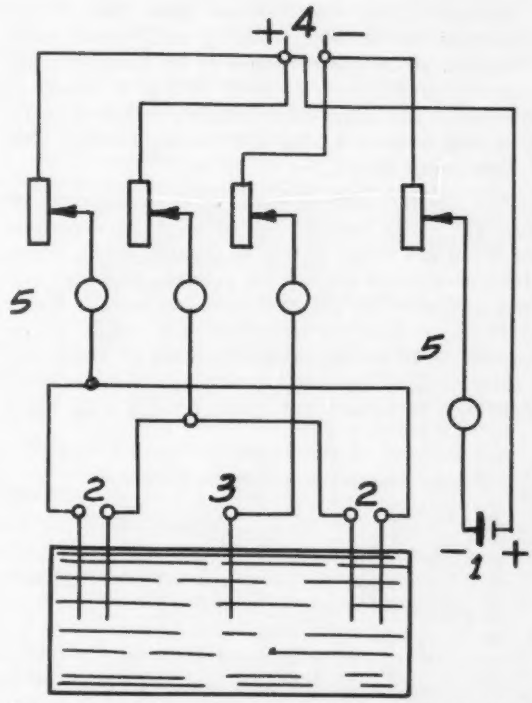


Fig. 1. Diagram of unit for producing thick deposits of nickel-cobalt alloy with separate anodes and individual current supply: 1—battery; 2—anodes; 3—cathode; 4—current source; 5—ammeters.

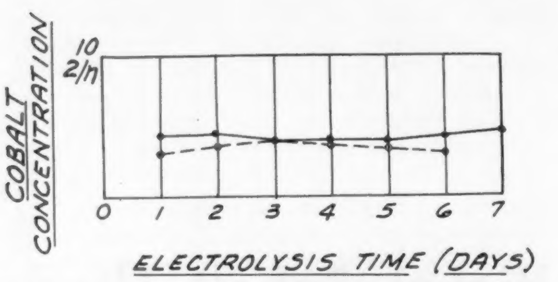


Fig. 2. Variation of cobalt content in nickel-cobalt electrolytes during bath operation with separate anodes.

clock supply of direct current to the bath was assembled (Fig. 1) to secure deposits of nickel-cobalt alloy with a thickness of 3 to 4 mm. Serving as current source was a 12-volt selenium rectifier. To its terminals were connected a 6-volt acid battery and a plating bath unit. The supply of current for the bath and battery was controlled by a rheostat and measured by an ammeter. A rectangular glass vessel of 7 liters capacity was used as plating bath. The anodes were made of nickel or from a Ni-Co alloy, or nickel and cobalt plates 100 x 40 x 5 mm in size, of electrolytic rolled metal placed in bags of synthetic fabric.

The electrolytic composition was maintained by various means, the report stated, and described the use of nickel-cobalt alloy anodes and of nickel anodes with a continuous dropwise feed of cobalt solution. These were found by experiment to be inefficient for various reasons. The method then adopted was to use separate nickel and cobalt anodes with individual current supply.

Analysis of the electrolyte was made daily during the deposition of thick layers of nickel-cobalt alloy. Variation of the cobalt content in the electrolyte was found negligible and is shown in Fig. 2, based on findings in two nickel-cobalt electrolytes during operation with separate anodes and roughly identical electrolyte composition.

The structure and properties of electrodeposited alloys are closely inter-related. Although the deposition of nickel and cobalt as well as of nickel-cobalt alloys, from weakly-acid electrolytes, proceeds with high current efficiency, the pH of the cathode layer is higher than in the body of electrolyte. The nature of the cathode layer during electrodeposition of nickel and cobalt is still obscure; some think that colloidal hydroxide is formed and others think a solid phase

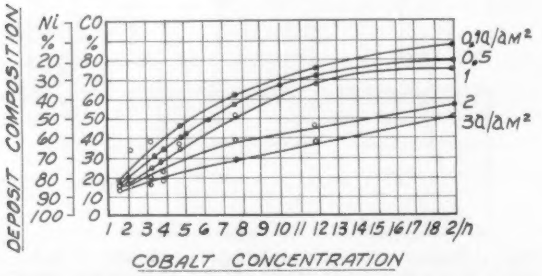


Fig. 3. Cobalt concentration variation in composition of nickel-cobalt alloy with cobalt concentration and current density.

of hydrate. Either way, even with a large magnification of an electrodeposited nickel or cobalt microsection, no crystal structure can be detected. This is possible only after annealing, during which recrystallization occurs.

Effect of Variables

Special experiments were performed to investigate the electrolysis process, the electrolyte composition and its ratio of nickel and cobalt salts, a constant electrolyte composition being sought to obtain an alloy of identical composition throughout the cross-section. Coincidence of the anode process with that of the cathode was viewed as essential for this purpose. The Russian report gives the following details:

A variable quantity of cobalt sulfate was added to the nickel sulfate solution, which contained boric acid as a buffer and sodium sulfate for conductivity. When studying the effect of various factors on the composition of the electrodeposited alloy, polished chrome-

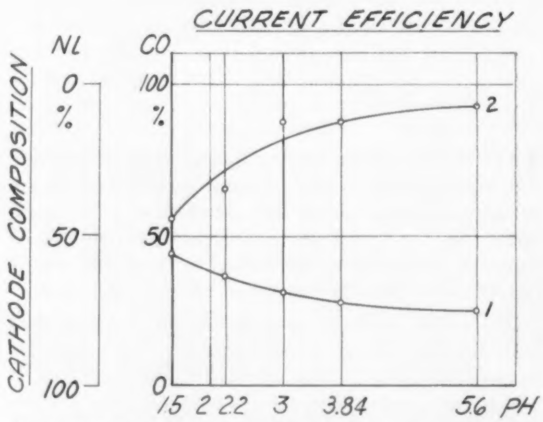


Fig. 4. Variation in composition of nickel-cobalt alloy and current efficiency with pH of solution containing 200 g./l. $NiSO_4 \cdot 7H_2O$, 30 g./l. H_3BO_3, 15 g./l. NaCl and 19 g./l. $CoSO_4 \cdot 7H_2O$ at 20 to 21°C.

nickel steel served as the cathode material, from which deposits were readily removed for chemical analysis. Brass served as the cathode material to obtain firmly bonded deposition for the purpose of examining their hardness and microstructure.

The study of the effect of cobalt salt concentration on the cathode deposit composition was made with an electrolyte composed of 200 g./l. $NiSO_4 \cdot 7H_2O$, 15 g./l. NaCl, and 30 g./l. H_3BO_3; pH = 5.6; temperature 20°C. Electrolysis was carried out in a glass vessel of 0.75 liter capacity. Rolled electrolytic nickel plates 100 x 40 x 5 mm in size were used as anodes. Stainless steel plates served as cathodes. Fig. 3 graphs the results of the experiments.

The findings show that, with increase in the electrolyte's cobalt concentration, the cobalt content of the deposit increases sharply. With increase of current density, the deposit's cobalt content is reduced.

The effect of pH was investigated in an electrolyte containing 19 g./l. $CoSO_4 \cdot 7H_2O$; the concentration of nickel salt, boric acid, and sodium chloride,

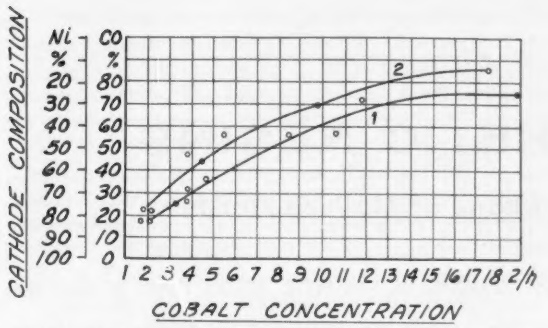


Fig. 5. Effect of agitation on comoosition with varied cobalt content in solution and initial electrolyte composition: 200 g./l. $NiSO_4 \cdot 7H_2O$, 30 g./l. H_3BO_3, and 15 g./l. NaCl; temperature 20°C., current density 1 amp./in.^{2} 1 — without mixing, 2 — with mixing.

was the same as before. Current density in all tests was maintained at 1 amp./in.^{2}. Temperature was in the range of 20-21°C. The tests were made with fresh portions of electrolyte with pH of the following values: 1.5, 2.2, 3.0, 3.8 and 5.6. The current efficiency was measured simultaneously.

The results are shown in Fig. 4, in which curve 1 characterizes deposit composition variation with pH, and curve 2 current efficiency. From the graph it is evident that, with the rise in pH from 1.5 to 3.8, the cobalt content of the deposit is reduced perceptibly and the current efficiency is increased. With further raising of pH, neither the deposit composition nor the current efficiency is changed markedly.

The experiments to determine the effect of agitation on the composition of the nickel-cobalt alloy deposits were conducted with an electrolyte of the composition cited previously, with varying cobalt content. Air was introduced by means of a perforated coil pipe. Electrolysis was carried out at a temperature of 19 to 20°C. and current density of 1 amp./in.^{2}. The test results are given in Fig. 5, from which it is evident that, with agitation, the cobalt content is increased somewhat.

The effect of the electrolyte's cobalt concentration on the deposit hardness was also studied.

Deposits with a thickness of 3 to 3.5 mm were measured on a Rockwell device with a diamond pyramid under a load of 150 kg. The initial electrolyte had the same composition as in previous tests. The cobalt concentrations were 2.6, 5.1, 5.7 and 8.7 g./l. The cobalt content of the deposit was respectively 21, 37, 41 and 57%. The tests were made without agitation, at a temperature of 20 to 21°C., current density of 1 amp./in.^{2}, pH = 5.6. The results are given in Fig. 6, from which it is evident that, under the conditions used, the alloy hardness rises appreciably with increase in cobalt content to 40%, above which further increase of cobalt content results in virtually no change.

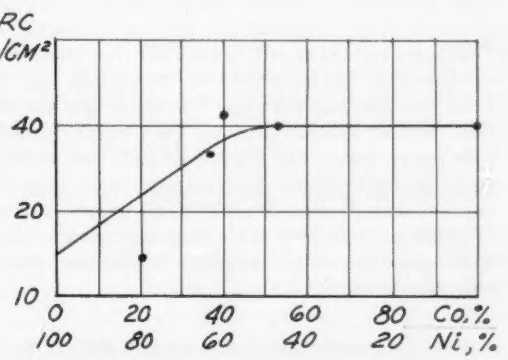


Fig. 6. Variation in hardness with Ni and Co contents.

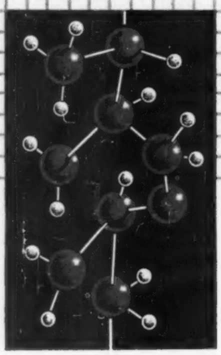
Experiments were also made with electrolytes containing ammonium sulfate. In individual cases, deposits with greater hardness were obtained, but the results were not very reproducible.

Discussion

A laminated deposit with layers parallel to the deposition surface, such as is formed when organic brighteners are used in nickel baths, is also formed in case of nickel-cobalt electrodeposition without organic brighteners, the report indicated. The layers are both thin and thick. On this feature, the report commented that the broad layers result from variation in the cobalt and nickel concentration. This is especially evident in a photomicrograph of an alloy specimen secured, using a nickel anode, when cobalt sulfate was added dropwise to the solution. In this case, the ratio of cobalt to nickel in the solution was variable and this, in turn, affected the nickel-cobalt alloy composition.

Since the alloys of variable composition reacted in differing degree with a mixture of nitric and acetic acids, the photomicrograph showed darker and lighter bands. A number of narrow bands are seen side by side with these wide bands. Reflected here, it seems, are not the changes taking place in the electrolyte mass, but the character of the cathode process. As when organic brighteners are put in nickel electrolytes, it is supposed that their cyclic electro-reduction and adsorption by the cathode surface, in the given case, can proceed from periodic formation of hydroxides together with metal deposits.

Along with the wide bands that correspond to changes taking place in the electrolyte mass, narrow bands are seen, corresponding to cyclic changes which occur in the cathode layer. It can be assumed that, in an ideally buffered electrolyte and with adsorbing organic compounds absent, the narrow bands will not be observed. However, it can hardly be assumed that the nickel-cobalt alloy deposition proceeds with 100% current efficiency or that the electrolyte can be buffered so ideally that the pH of the cathode layer might continue to remain constant. The electrolytic conditions (temperature, current density, mixing, concentrations, and effectiveness of buffer compounds in the electrolyte) have an effect on the variation of the pH value in the cathode layer. That is why, when examining a microsection under the microscope, the stratified structure is seen in some places and missing in others. The point is that an identical current density is not preserved in all sections of the specimen, and the pH values of the cathode layer are not identical.



SYNTHETIC RESINS

The Backbone of Modern Finishes

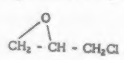
A SURVEY OF THE LATEST DEVELOPMENTS IN SYNTHETIC RESINS USED IN COATINGS

Part VI - Epoxy Resins (Section A)

By Harold P. Preuss

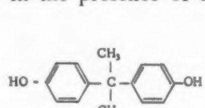
THE epoxies* represent one of the newest resin families to have been introduced on the market. They were specifically developed, based on theoretical considerations, to have certain desirable properties primarily for use in the coating and electrical fields, but their usage has spread to other kindred fields. In the classification of resins outlined in the first article of this series (June, 1960), epoxies belong to Group 4, namely resinous products containing ether groups.

Historically, the formulation of epoxy type compounds was first described by Lindeman in Germany in 1891. No further development took place, however, until Castan of Switzerland began experimenting with them in 1938. Actual development work in the use of epoxy resins in surface coating applications goes back to about 1947. Meanwhile, a great deal of research work had been carried out between 1938 and 1947 by CIBA in Switzerland and by Jones-Dabney and Shell in this country. Real progress began in the United States in 1947 when epichlorohydrin,

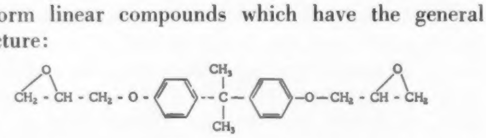


became commercially available.

This chemical in the presence of alkali reacts with bisphenol A,

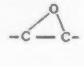


to form linear compounds which have the general structure:



This is the common basic epoxy polymer. It is quite resistant to hydrolysis and saponification and to a variety of chemicals.

*The term "epoxy" in organic chemical nomenclature is a prefix denoting an oxygen atom joined to each of two other atoms which are already united in some other way, as,



Curing Epoxy Resins

Unmodified epoxy resins, however, even when baked, yield films of limited utility. The really outstanding properties of adhesion, flexibility, toughness and chemical resistance are obtained by chemical reaction with "curing agents" which convert the epoxy resin to chemically and mechanically strong polymers. Of these curing agents, amines, such as diethylene triamine, have been found to be the most effective. Another useful curing agent is represented by the Thiokols (synthetic rubbers) used in conjunction with an amine. Still another method for curing epoxy resins is by reaction with aminoplasts† or phenoplasts.‡ These usually require curing at high temperatures with a small amount of acid catalyst.

The aliphatic polyamines are examples of room temperature hardeners. They are very economical; their low viscosity makes them easy to handle and easy to mix with the epoxy resins. Examples of typical aliphatic polyamines are Triethylene tetramine (TETA),* Tetraethylene Pentamine (TEPA),* and Diethylene triamine (DETA).* The latter is a low viscosity volatile liquid which reacts readily with epoxide compounds to form insoluble thermosetting systems. Because of its high vapor pressure and toxic nature, careful handling precautions should be observed when working with this curing agent. In addition to the amine curing agents, some formulations suggest the use of Versamid resins (General Mills Corporation), such as *Versamid 115*. This is an amber colored viscous polymer made by the condensation of dimerized or trimerized oil fatty acids and ethylene diamine. Versamids are less toxic than the low viscosity amines. They readily crosslink with epoxy resins, but require longer cures or higher temperatures to obtain optimum properties. They often improve the adhesion, flexibility and impact resistance of cured systems. They are seldom suggested for use in applications where low viscosity or ultimate chemical resistance is required.

†Resinous products produced by the interaction of an aldehyde with an amine.
‡Cold setting liquid phenolic resin coatings.
*The Dow Chemical Company.

Many hardeners cure at elevated temperatures to develop ultimate physical properties. This category includes aromatic amines, catalytic hardeners and organic anhydrides. The high temperature performance of systems cured with these hardeners is generally better than that obtained from systems cured with room temperature hardeners. *Methylene dianiline (MDA) and Meta-Phenylene diamine (MPDA)*† are typical aromatic hardeners. These hardeners are usually melted and blended with resin that has been warmed to 200-220°F. The resin mixture must be kept warm initially until partial reaction takes place or the hardener may crystallize out of the mix. *Diamino diphenol sulfone (DDS)* is an aromatic amine which gives very good performance at temperatures above 350°F. This hardener has limited solubility in epoxy resins but may be dissolved and blended in the resin at temperatures above 200°F. The curing rate is considerably slower than that found with most aromatic amines.

Catalytic hardeners usually provide very long pot life. They are used in small amounts and usually require long cures. The high temperature performances of catalyst cured systems is excellent. Examples of catalytic hardeners are the BF_3 amine complexes, the tertiary amines, and the acid salts of tertiary amines.

Numerous organic anhydride hardeners are available for different applications. Examples include:

Phthalic Anhydride is a low priced hardener which has high vapor pressure and which may readily depolymerize at high temperature.

*Hexahydro Phthalic Anhydride (HHPA):** this hardener is easy to work with because it has a low melting point and is soluble in the resins. The pale color of this hardener is often used to advantage in electrical castings.

*Methyl Nadic Anhydride (MNA)** is a liquid and easy to mix with the resins. MNA systems have excellent high temperature performances.

*Dodecenyl Succinic Anhydride (DDSA)** is a liquid and easy to mix with the resins. The long aliphatic chain on DDSA imparts greater flexibility to cured castings.

*HET or Chlorendic Anhydride*** is used to produce flame retardant systems. It has a high melting point and is difficult to dissolve in the resin. It has fast rate of cure.

*Pyromellitic Dianhydride (PMDA)**** develops systems with excellent high temperature properties. The hardener has poor solubility in the resins and must usually be blended with other anhydrides such as maleic, to improve the solubility.

Types of Epoxy Resins Used in Finishes

The surface coating field probably represents the largest end use for epoxy resins. Among the epoxy finishes most familiar to those experienced in the finishing industry are those of the epoxy ether variety. They are similar in appearance and handling properties to alkyd resin finishes, but are superior in chemical resistance, adhesion, flexibility and toughness.

Epoxy resins fall into two broad classifications, namely, liquid resins and solid (hard) resins. The coating properties developed by solid (hard) epoxy resins are characterized by:

1. Corrosion resistance — coatings have excellent resistance to corrosion under the most extreme circumstances.
2. Solvent and chemical resistance — coatings are impervious even to hot acetone and hot caustic.
3. Chemical inertness — coatings accept a wide range of fillers and pigments; they are suitable for use over most substrates and in most environments.
4. Hardness — coatings not only are hard but also have excellent toughness and shock resistance.
5. Adhesion — the tenacity of epoxy adhesion to almost any surface is without equal among organic coatings.
6. Simplicity of formulation and ease of use.

Hard epoxy resins must be dissolved in solvents before being used in coatings. The active solvents for epoxies are ketones and esters, while alcohols may be used as latent solvents and aromatic hydrocarbons as diluents. Generally, the thinners are approximately 50% active solvents and 50% diluents, although the lower molecular weight resins will tolerate more diluent, while the higher ones may require more active solvent. For brushing or roller coating application, slow aromatic solvents are used, such as diacetone alcohol, cellosolve acetate, or cyclohexanone, combined with slow aromatic solvents. For spray application, faster solvents may be used, such as MEK, MIBK, ethyl alcohol, toluol and xylol. Many paint manufacturers find it more convenient to purchase the resins in the solution form. Since epoxy solutions tend to be cloudy unless filtered carefully, the use of these filtered solutions makes it easier to produce coatings with high clarity.

Liquid epoxy resins, with a lower molecular weight than the solid types, may be converted to a thermosetting solid in a similar manner as the polyesters, phenolics, and melamines. They are generally superior to these resins, however, in the following properties (as well as in those characteristics outlined earlier for hard resins):

1. No volatile loss during cure.
2. Dimensional stability during cure — they have very little shrinkage and can be used for very accurate reproduction.

Epoxies have made possible the development of protective coatings which, when applied to a surface, react chemically and build a polymer in place which would then have the properties of a baked film without the baking operation. This is accomplished by means of a two-component package. The first component consists of the resin solution, while the second component consists of the "curing agent" or hardener.

†E. I. DuPont, Antara Chemical Company.
*National Aniline Division, Allied Chemical & Dye Corp.
**Hooker Chemical Corp.
***E. I. DuPont.

Application to walls, floors, etc. may be by means of special two-component spray equipment.

Specially compounded epoxy resins blended with other components may also be used as fluidized bed coatings. The substrate coating temperature is in the range of 180°-200°C. It is also advisable to afterbake the coating for 30 minutes at 200°C. to achieve optimum electrical and physical properties and to preserve maximum solvent resistance.

Toxicity

Certain precautions should be observed by the formulator and user of all liquid and solid type epoxy resins, as well as hardeners, concerning their possible toxicity.

Liquid Type Resins

Uncured or green resins are not particularly irritating to the skin. However, they are capable of causing sensitization responses, such as rashes, in humans. The epoxy resins are considerably less potent in this repect than are the curing agents or diluents. These resins are low in acute oral toxicity. Eye contact will result in only slight, transient irritations. The cured epoxy resin presents no problem from skin contact or ingestion. Many of the curing agents in general use are capable of causing serious irritation, even a burn, depending upon the degree of contact. These materials may cause, in addition, a serious rash in sensitized persons by skin contact with the liquid or solid, or by contact with the vapor. This response may develop after several weeks or months of contacts that caused no apparent effects, or it may result from a single massive exposure. Cases of asthmatic type responses in humans who have become sensitized by breathing of the vapor of these curing agents — particularly amines — have been reported. The curing agents are low in acute oral toxicity. They are capable of causing severe irritation and damage upon contact with eyes.

The diluents may cause primary skin irritation in a high percent of people. However, as with the curing agents, these materials may also cause serious effects in humans because of sensitization resulting from skin contact. The diluents are considered to cause sensitization in a greater number of people than are the curing agents. The possibility of sensitization to the vapors of these materials, although not reported, should not be overlooked. Eye contact may result in transient irritation and possible slight corneal injury which heals quickly. They are low in acute oral toxicity.

Solid Type Resins

These materials are also low in acute oral toxicity and are only very slightly irritating to the eyes. They cause essentially no irritation to the skin. However, because of their chemical nature, sensitization of the skin may occur. The possibility that skin sensitization may occur from the solid resins is considerably less than that encountered with liquid resins. Solvent solutions of solid epoxy resins, however, are considered to be more irritating to the skin and eyes than are the solid resins themselves. Skin sensitization responses will occur more readily from contact with resin solutions than from contact with solid resins alone. The solutions are low in acute oral toxicity.

The drying oil fatty acid type curing agents sometimes used are low in toxicity by ingestion, by skin contact, and from eye contact. Occasionally an individual has been reported to develop a skin irritation from repeated prolonged contact. Many of the solvents suggested for use with solid epoxy resins are fat solvents (fat solubilizing materials) and are therefore capable of causing skin irritation and rashes in humans. Most of them are low in toxicity by ingestion and cause at most slight to moderate transient irritation when in contact with the eyes. Many of them may cause systemic injury when their vapors are breathed in excessive amounts. The concentration of vapors in the breathing zone of the user must be controlled and maintained within acceptable levels. The degree of control necessary will depend on the particular solvent used and the intensity of the exposure.

Suggested Handling Precautions

In the use of epoxy resins, skin contact with the low molecular weight amine-type curing agents, and with the epoxy resin solutions, must be avoided. This may be accomplished by handling the materials in a closed system. If this is not possible, then other adequate precautions must be taken to prevent skin contact.

Specific instructions as to the precautions necessary to prevent contact cannot be given for all operations. However, the following practices have been used in various combinations to control the hazards engendered both by skin contact and inhalation.

1. All personnel concerned with the handling of these materials must observe strict cleanliness of their person and of the area in which they work. There is no substitute for strict cleanliness and housekeeping.
2. Continued instruction of all employees must be given concerning the consequences of contact as well as the precautions necessary for safe operation.
3. Suitable protective clothing to prevent contact should be worn. The particular type of clothing depends on the operation. Impervious clothing can increase the hazard if it becomes contaminated on the inside.
4. Minimize or eliminate the contamination of the work area by placing clean disposable paper on tables or benches. The paper should be changed immediately following gross contamination.
5. Contact with materials should be reduced by the use of disposable utensils such as paper dippers, etc.
6. Contact with the vapor should be prevented. Sufficient ventilation at the point of generation to remove all vapor must be provided.
7. Isolate the operation from other work areas, thus limiting the direct exposure of untrained workmen and the transfer of the materials by way of contaminated tools and equipment.

Sources of Epoxy Resins

Epoxy resins for use in surface coatings are manufactured in the United States by a number of firms. In this first article on epoxies we will discuss the char-

acteristics of resins made by Ciba Products Corporation, Fair Lawn, N. J.; Reichhold Chemicals Inc., White Plains, N. Y.; and The Dow Chemical Company, Midland, Michigan. The next article in this series will discuss resins made by other firms.

Ciba Resins

Ciba Products Corporation manufactures in the United States a range of epoxy resins, hardeners and modifiers to suit various application requirements. These resins, known by the trade name *Araldite*, are of both the liquid and solid types.

Resin 502 is a liquid epoxy resin which finds use in masonry finishes and in chemical resistant finishes. Solid Araldite resins are designated by the numbers *6071, 6075, 6084, 6097, 6099, 7071*, and *7097*. Of these, Resin 7071 and Resin 7097 represent completely new types. The former is designated for use with amine type curing agents in room temperature curing systems, whereas Resin 7097 is used primarily in conjunction with phenol-formaldehyde and urea-formaldehyde resins in baking systems.

Table 1 describes the properties of the basic Araldite resins. Table 2 lists the specific uses for the var-

TABLE 1

Properties of Unmodified Types of Epoxy Coating Resins*

MFR.	TYPE OF RESIN	LIQUID OR SOLID	VISCOSITY GARDNER-HOLDT	SP. GR. LBS./GAL.	EPOXIDE EQUIVALENT ①	CHLORIDE %	MELTING POINT (DURRANS) °C	COLOR, MAX. (GARDNER '33)
CIBA	ARALDITE 502	LIQUID	$Z-Z_2$	9.3-9.6	263	–	–	3
	ARALDITE 6071	SOLID	D-G ②	9.9	485	–	65-75	4 ②
	ARALDITE 6075	SOLID	I-J ②	9.9	715	–	85-95	4 ②
	ARALDITE 6084	SOLID	R-V ②	9.9	950	–	95-105	4 ②
	ARALDITE 6097	SOLID	$Z-Z_2$ ②	9.8	2200	–	125-135	5 ②
	ARALDITE 6099	SOLID	Z_2-Z_5 ②	9.8	3200	–	145-155	5 ②
	ARALDITE 7071	SOLID	D-G ②	9.9	485	–	65-75	4 ②
	ARALDITE 7097	SOLID	X-L ②	9.8	1800	–	113-123	4 ②
REICHHOLD	EPOTUF 6125	LIQUID	Z_6	10.0	185-225	–	–	–
	EPOTUF 6130	LIQUID	S-V	9.4	175-210	0.2 MAX.	–	–
	EPOTUF 6131	LIQUID	Z_2-Z_3	9.6	255-265	0.2 MAX.	–	–
	EPOTUF 6140	LIQUID	Z_5-Z_6	9.65	175-210	0.2 MAX.	–	–
	EPOTUF 6301	SOLID	C-G ②	9.6-10.4	450-525	–	63-77	8 ②
	EPOTUF 6304	SOLID	Q-U ②	9.6-10.4	875-1000	–	93-104	7 ②
	EPOTUF 6307	SOLID	$Y-Z_1$ ②	9.6-10.4	1550-2000	–	125-135	9 ②
	EPOTUF 6309	SOLID	Z_2-Z_5 ②	9.6-10.4	2400-4000	–	145-155	12 ②
DOW	D.E.R. 331	LIQUID	Z_5-Z_6	9.8	187-193	<0.249	–	5
	D.E.R. 332	LIQUID	Z_4 MAX.	9.7	179 MAX.	<0.249	–	1
	D.E.R. 334	LIQUID	R-T	9.4	178-186	<0.349	–	5
	D.E.R. 661	SOLID	G-J ②	9.9	475-575	0.14	74-80	1 ②
	D.E.R. 664	SOLID	R-V ②	9.9	875-985	0.14	95-103	3 ②
	D.E.R. 667	SOLID	$Y-Z_1$ ②	9.6	1600-2000	0.14	120-128	1 ②
	D.E.N. 438	SEMI-SOLID	A ③	10.1	175-182	0.249	–	5

① Grams of resin per gram mole of epoxide.

② 40% non-volatile in diethylene glycol monobutyl ether.

③ 80% non-volatile in diethylene glycol monobutyl ether.

* The manufacturers listed above also supply their solid types of epoxy resins as solutions in various solvents. These are not listed. Data on these may be obtained from the manufacturers.

TABLE 2

Types of Finishes Which May be Produced from Araldite Coating Resins

	Type Resin							
Type Finish	*502*	*6071*	*6075*	*6084*	*6097*	*6099*	*7071*	*7097*
Equipment finish		*		*			*	
Marine finish		*		*			*	
Masonry finish	*	*					*	
Structural steel coating		*		*			*	
Tank coating		*		*			*	
Aircraft finish		*					*	
Appliance primer					*	*		*
Automotive primer				*				
Can and drum liner			*		*	*		*
Chemical resistant finish	*	*			*	*	*	*
Collapsible tube coating			*					
Furniture finish		*			*		*	*
Metal decorating finish			*	*	*			*
Pipe and tank lining					*	*		*
Concrete floor paint		*		*			*	
Gym and floor varnish				*				
Spar varnish				*				

ious types of liquid and solid Araldite resins made by Ciba for use in coatings. Solid Araldite resins are available also as solutions in various solvents.

Reichhold Resins

Epoxy resins made by Reichhold are of several types, all known by the general trade name *Epotuf*. The liquid resins are designated *6125, 6130, 6131* and *6140*, while the hard resins, in order of increasing molecular weight, are numbered *6301, 6304, 6307* and *6309*. Properties of these resins are outlined in Table 1. The hard resins are also used in solvent solutions.

The *6307* and *6309* resins are commonly used to produce epoxy-phenolic coatings, which are the most chemically resistant of the epoxy finishes. These form one-component baking systems consisting of a solution of epoxy resin combined with a heat-reactive phenolic resin. A ratio of 75 parts *6307* and 25 parts phenolic is often used. Phosphoric acid or other acid catalysts are sometimes added to increase the rate of cure, usually at the rate of 1-2% of vehicle solids. Triethanolamine at the rate of 2% based on epoxy solids may be used as a catalyst. A flow control agent, such as a silicone oil or resin, butyral resins, or ethyl cellulose, usually is added in small amounts to prevent cratering. Increasing the amount of epoxy tends to improve adhesion, but decreases solvent resistance. The coatings can be pigmented by dispersing pigments in the epoxy solution.

The coatings are usually applied by spraying at 25-30% non-volatile, and baked at 350°F. for 30 minutes. The resulting films are resistant to alkali, acids and solvents, and have good abrasion resistance, impact resistance and adhesion. The chief disadvantage of these coatings is dark color due to the phenolic resin. They are used for lining tanks, drums and other equipment where extreme chemical resistance is required.

Epoxy-urea finishes have better color than the epoxy-phenolics, and can be used for white or pastel appliance finishes. They also tend to have better flow than epoxy-phenolics. They are easily pigmented by grinding in either the epoxy or urea resin solutions, although better wetting is obtained with the urea resin. Best results have been obtained with a ratio of 70 parts *Epotuf 6307* to 30 parts Beckamines* P-196 or P-138. Increasing the epoxy content improves gloss and chemical resistance, but decreases hardness, rate of cure and solvent resistance. The package stability is good, as coatings have been observed for nine months without showing any substantial viscosity increases. Coatings should be baked at a minimum temperature of 350°F. for at least 20 minutes. If baked at lower temperatures, they may appear to be cured, but will not have maximum flexibility. Properly cured coatings have good gloss, impact resistance, adhesion, and solvent and chemical resistance. Baking schedules can be reduced by using acid catalysts. Beckamine P-198 speeds cure to some extent, while paratoluene sulfonic acid is very effective. Using PTSA in amounts of 1-2% based on urea resin solids content, curing temperatures can be lowered to 275-300°F. for 30 minutes. There is also an improvement in hardness and solvent resistance. On the other hand, the use of catalyst lowers gloss, decreases viscosity stability and decreases adhesion, which may cause more rapid failure in immersion and salt spray tests. Epoxy-urea coatings, both clear and pigmented, have a wide range of application, including finishes for washing machines and other appliances, laboratory furniture, and finishes for brass, aluminum and other metals. Their chief advantages over alkyd-urea and alkyd-melamine baked finishes are better chemical resistance, especially to alkali, better adhesion, and better flexibility and impact resistance.

(To be continued)

*See Part IV of this series; September, 1960.

Measuring Loads for Steel Nuts

By George Clayton Field, Brookfield, Wisconsin

THE accompanying charts on the two following pages are similar to those used for the purpose of measuring loads of steel washers and spacers, recently published in METAL FINISHING. The chart for calculating areas is an improvement over the one published in the September 1941 issue. It is designed to give the approximate total square feet of surface area for 1000 pieces with only one positioning of the straight-edge. It is necessary to know the distance across the flats, the thickness of the nut, and the size of the threaded hole.

Surface Area Determination

To find the surface area of a nut, use chart Fig. 1 and select a point on the left half of the chart where the D. A. F. (distance across flats) line intersects the perpendicular thickness line. Read horizontally to the right to find the square feet per 1000 pieces at line "A".

Having found the outside area of the hexagon surface and two faces, without a hole, the next step is to select the diagonal line that shows the size of the threaded hole. Find the point of intersection with the perpendicular thickness line and read the plus or minus quantity of square feet per 1000 on line "C". Lay the straight edge across from the point on line "A" to the point on line "C" and find the total square feet per 1000 on line "B". However, it is not really necessary to read the "A" and "C" scales if one wishes to read it more directly.

Example: If we desired to measure the area of a nut ¼″ thick x ½″ D. A. F. with a ¼″-20 threaded hole, merely mark the point where the perpendicular line intersects the ½″ D.A.F. diagonal line on the left hand chart and then, on the right half of the chart, mark the point where the ¼″-20 thread, diagonal line intersects the ¼″ thickness, perpendicular line on that side. Lay a straight edge across these two points, so marked and find 7½ sq. ft. per M pieces on the line "B", the total surface area of the nut.

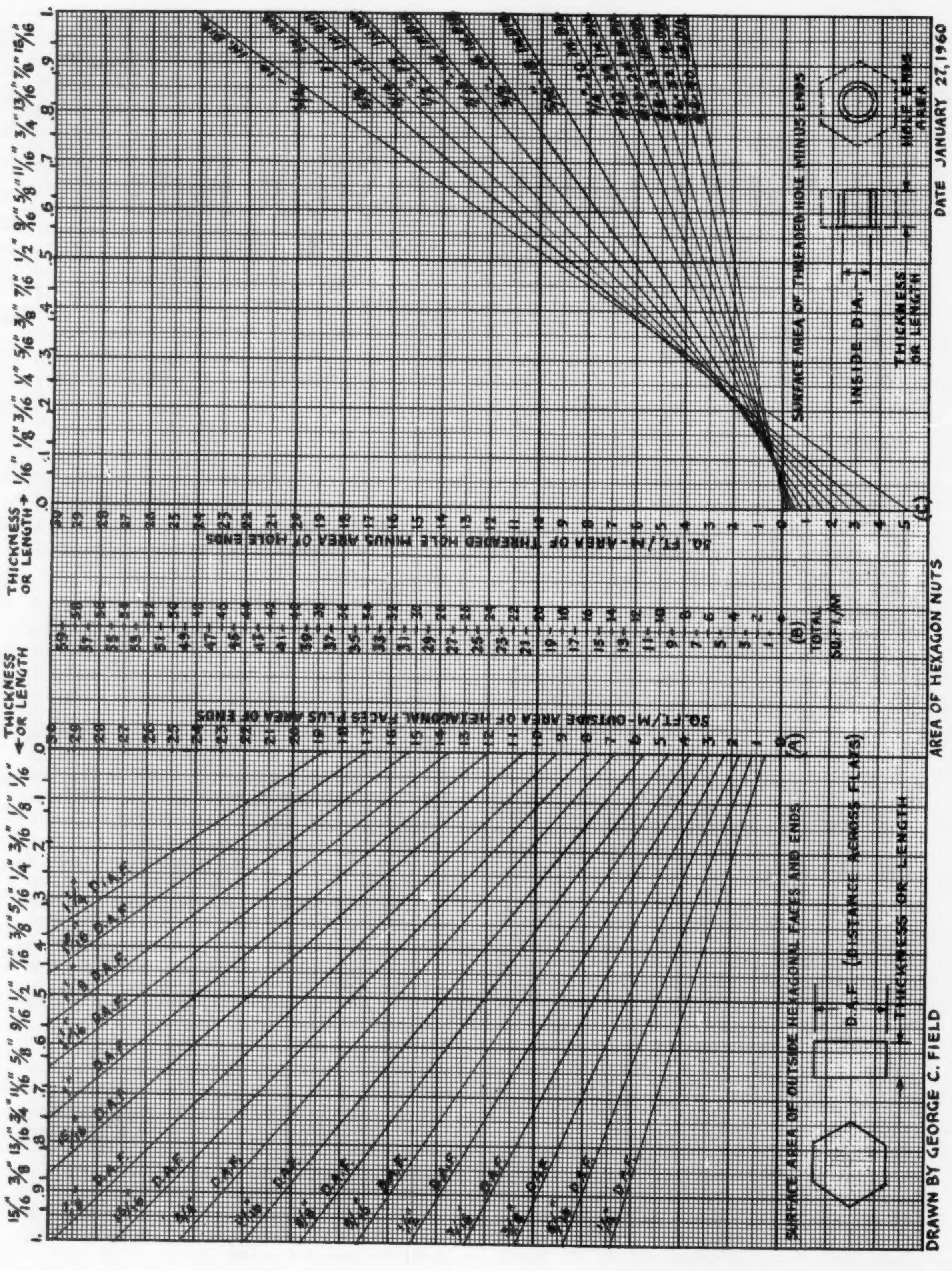
Weight Determination

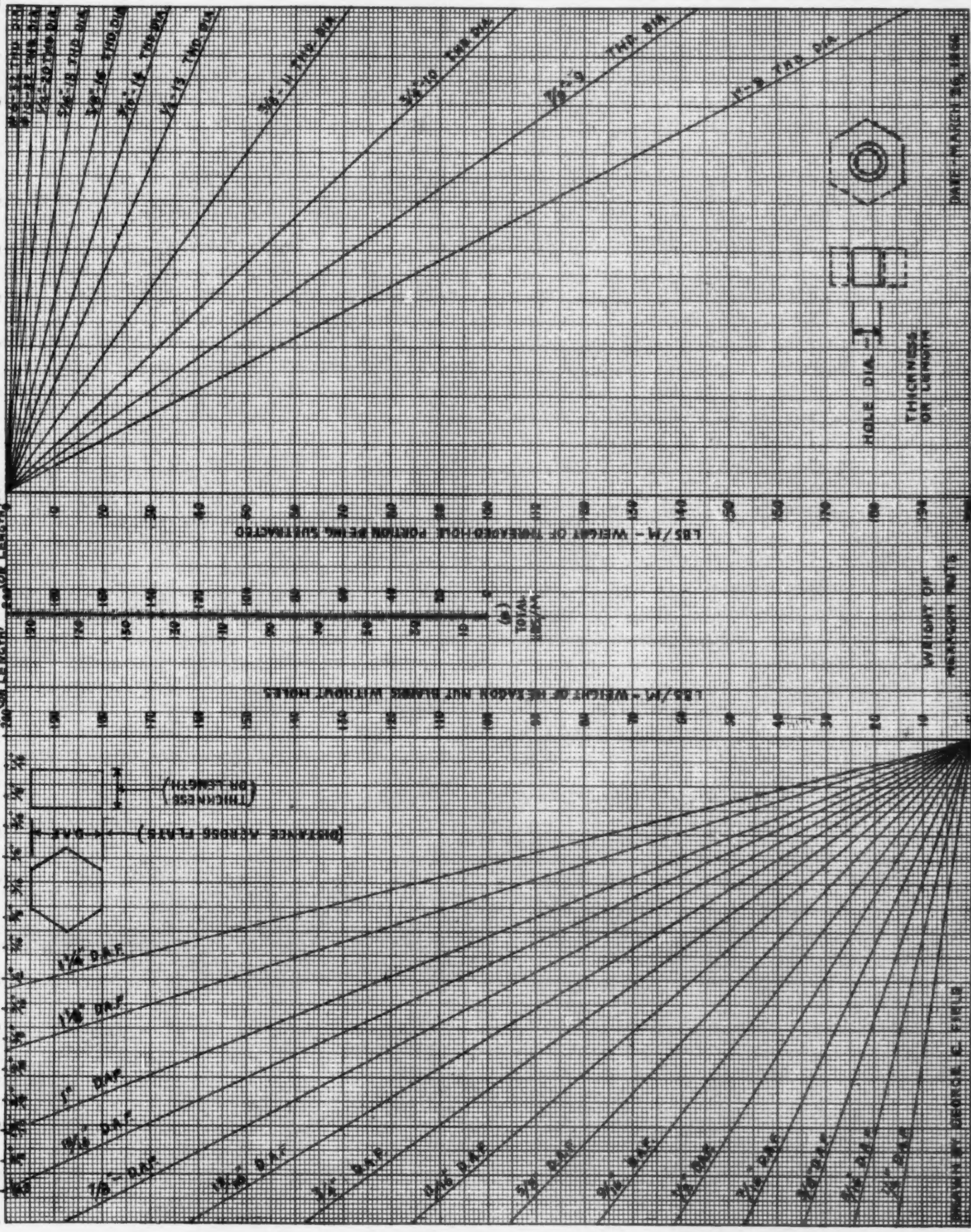
The chart (Fig. 2) for measuring the weight of nuts is constructed on the same general plan as the area chart, except that weight in pounds per 1000 pieces is the objective and, therefore, no provision need be made for addition such as that required to measure the inside surface of the threaded hole as seen in Fig. 1. The purpose here is to subtract the weight of the steel that was removed to produce the hole. This is done by marking the chart similar to example described above for area.

Example: To find the weight of a nut ¼″ thick x ½″ D. A. F. with a ¼″-20 threaded hole, find the point where the ½″ diagonal (D.A.F.) line intersects the ¼ perpendicular line on the left hand side of the chart; then find the point where the ¼″-20 diagonal line intersects the ¼″ perpendicular line on the right hand chart. Lay the straight-edge across these two points and read 13 pounds per 1000 pieces on line "B". The lines "A" and "C" need not be read when the straight-edge is located from points found in the body of the two halves of the graph directly. The operation of reading the graph will be easier if the points for locating the straight-edge are marked with a pencil which can be erased after use.

The figures obtained from using these charts are only approximate, but are accurate enough to measure loads for all kinds of plating such as horizontal barrels, automatic plating, tumbling, and dipping.

If the nuts being calculated are of other metals than steel, then the weights may be converted by multiplying the totals by various factors as follows: For brass, multiply total weight by 1.08. For bronze, multiply by 1.12. For copper, multiply by 1.14.


AREA OF HEXAGON NUTS
SURFACE AREA OF OUTSIDE HEXAGONAL FACES AND ENDS
D.A.F (DISTANCE ACROSS FLATS)
THICKNESS OR LENGTH
SQ. FT./M - OUTSIDE AREA OF HEXAGONAL FACES PLUS AREA OF ENDS
(A)
(B)
TOTAL
SQ.FT./M
SQ. FT./M - AREA OF THREADED HOLE MINUS AREA OF HOLE ENDS
(C)
SURFACE AREA OF THREADED HOLE MINUS ENDS
INSIDE DIA.
HOLE ENDS AREA
DRAWN BY GEORGE C. FIELD
DATE JANUARY 27, 1960



LBS/M - WEIGHT OF THREADED-HOLE PORTION BEING SUBTRACTED
LBS/M - WEIGHT OF HEXAGON NUT BLANKS WITHOUT HOLES
WEIGHT OF HEXAGON NUTS
HOLE DIA.
THICKNESS OR LENGTH
DISTANCE ACROSS FLATS

FINISHING POINTERS

PROPER GLOVE CARE

THOUSANDS of dollars are lost each year through improper care of industrial workers' gloves. And the toll keeps mounting, with increases in the nation's industrial labor force.

Gloves are an industrial "tool," often with highly specialized uses, such as the very fine, tissue-thin surgical gloves borrowed by industry from the medical profession, for anti-tarnish inspections. They are entitled to the same degree of care as any other specialized plant tool. The following suggestions are offered for glove care and maintenance:

Putting on Gloves

1. Turn back cuff of gloves about two inches. (If gloves appear to be a snug fit, they should be pre-powdered with talc or soapstone for greater ease in putting them on). Grasp cuff on palm side of glove between thumb and "V" of forefinger (Figure 1). This prevents fingernails from injuring gloves.
2. Insert fingers into glove and, while slowly raising both hands to chest-high, push on glove. Unfold cuff.
3. Repeat this procedure with other glove.

Removing Gloves

1. Turn back cuff of glove about two inches. Grasp cuff on palm side of glove between thumb and "V" of forefinger (Figure 1).
2. Slowly raise both hands to chest-high and, at the same time, pull off glove (Figure 2).
3. With fingers of glove pointing down and palm side outward (Figure 3) twirl glove upward toward body to trap air inside gloves.
4. Quickly squeeze cuff of glove tightly to hold trapped air (Figure 4). With thumb on palm and forefinger on back, press on bulge in glove to force trapped air to straighten thumb and fingers.
5. Repeat this procedure with the other glove.

Air-Testing Gloves

1. With fingers of glove pointing down and palm side outward, similar to Figure 3, twirl glove upward toward body to trap air inside glove.
2. Squeeze cuff of glove tightly to hold trapped air (Figure 4). With thumb on palm and forefinger on back, press on bulge in glove to further inflate glove.
3. Hold inflated glove close to face and ear. Listen for air escaping from holes.
4. Repeat this procedure with the other glove.

Care of Gloves

1. Never leave gloves inside-out. This traps vapors which will quickly deteriorate the gloves and make them more subject to ozone cracking.
2. Never leave gloves with cuffs folded over. This places the folded part under stress, weakening it and causing it to tear easily.
3. Periodic cleaning of gloves is fundamental to remove the build-up of solvents, degreasing agents, etc., which shorten glove life. Gloves with "firmhold" or rough finishes require thorough cleaning because the "depressions" or "valleys" forming the finish trap solutions which will deteriorate the glove.
4. Where swelling of gloves occurs, take the gloves out of usage, to permit solvents to evaporate off the glove, thus restoring original shape. Rotate several pairs of gloves in this situation, since swelling of glove reduces its resistance to tearing.
5. Above all, wear gloves that fit properly. Proper fit eases putting on and removing gloves without abusing them.

Industrial gloves are the first line of defense against serious occupational hazards to workers' hands. At any cost, they are still the cheapest form of safety insurance.

FIGURE 1

FIGURE 2

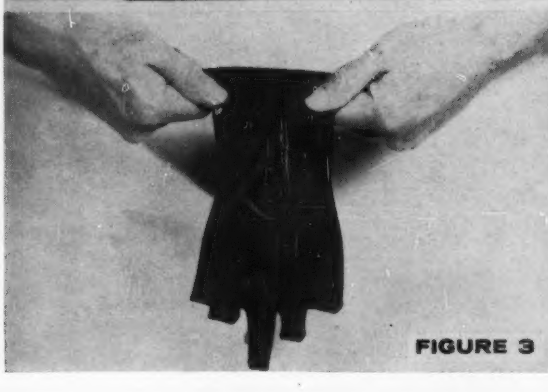


FIGURE 3

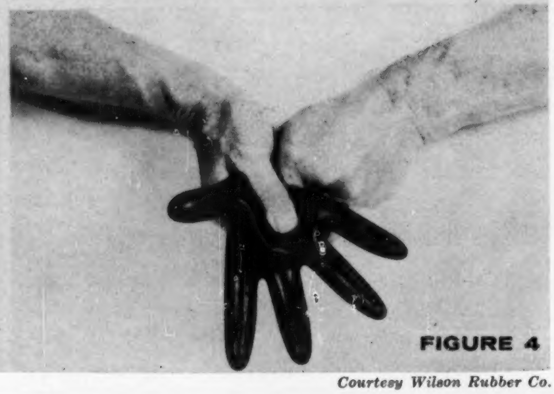


FIGURE 4

Courtesy Wilson Rubber Co.

Science for Electroplaters

62. Adhesion Tests

By L. Serota

QUANTITATIVE tests for the measurement of adhesion of electrodeposited coatings entail, essentially, the adaptation of a device which will pull or detach the deposit from the basis metal. Among the methods used for such testing are the following: soldering of a handle (or cylinder) to the deposit, first introduced by C. F. Burgess; electrodeposition of a heavy knob on the end of a rod and detachment in a measuring device, devised by E. A. Ollard, and a number of modifications such as those developed by E. J. Roehl and B. B. Knapp; the cement test introduced by A. L. Ferguson and M. V. Tsoo; the P. A. Jacquet test of forming a thick deposit; the nodule method suggested by A. Brenner and V. D. Morgan.

No one of these methods, H. C. Schlaupitz and W. D. Robertson imply, qualifies for an ideal test, owing to the difficulty in analyzing the complicated phase of the state of stress existing at the interface, a condition associated with the fact that the interface consists of two different metals. The effect of the unsymmetrical arrangement will be to produce different stress states on opposite sides because of differences in moduli and flow characteristics.

Although the modified Ollard tests are considered to be the most satisfactory quantitative methods, the need for a heavy deposit, even in these tests, and the care required in preparation and machining of the specimens, make them unsuitable, A. Brenner contends, for use in other than research.

Burgess Test

The need for a method for determining the degree of adhesion of zinc coatings led to the development in 1905, by C. F. Burgess, of a device for obtaining a direct tensile test by soldering with a low melting solder, a copper plug (a handle), ½ in. in diameter, to the zinc surface. The pull required to separate the plug (and zinc) from the iron, as indicated by a spring balance, was considered a measurement of the adhesion of the zinc to the iron. A probable error, acknowledged by the author, was attributed to the fact that the heat used in soldering could affect the adhesion of the coating.

Ollard Test

The Ollard adhesion test provides a method of evaluating the efficiency

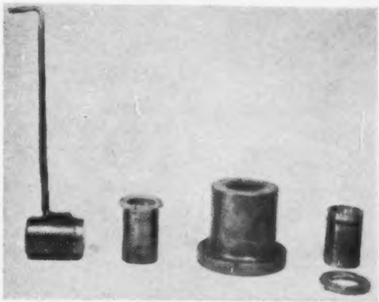


Fig. 1.

of various etching methods for basis metals prior to nickel plating. A machined steel rod, 1 inch in diameter and 1.50 inches long is fitted with a connecting rod (Fig. 1A), then stopped off with wax, except one end. The exposed metal end is then cleaned by the method desired, and a nickel deposit about 0.10 inch thick is made electrolytically. The wax is removed and the test piece machined so that the length of the rod from the unplated end to the underside of the deposited nickel is now 1.51 inches. In Fig. 1B, it will be noted, 0.01″ of nickel is machined. The presence of nickel on the cylindrical part of the test piece, thus, is eliminated and the nickel-metal interface will be below the shoulder of the finished specimen when it is placed in the testing apparatus. A hole ¾″ in diameter is drilled through the nickel and basis metal, as observed in Fig. 1B, to a depth of ⅜″. The specimen is now placed in the die, Fig. 1C, and adhesion determined by measuring the load required to detach the nickel deposit (annular ring) from the cylinder when a load is applied by means of a rod in a tensile machine. The detached nickel deposit (ring) is shown in Fig. 1D.

Adhesion in terms of pounds per square inch may be calculated from the data relating to the value of the load and the area of contact between deposits and basis metal. A cross-section diagram of a test specimen indicating detailed dimensions, just before breaking in the tensile machine, is shown in Fig. 2.

Results obtained by Hothersall, using the Ollard method, for adhesion values of electrodeposited nickel to various basis metals are shown in Table 1. The tests, Hothersall indicates, may not provide absolute values, since a low value for adhesion may result from a tearing action resulting from concentration of stress at the outer edge of the interface. Such conditions, Roehl states, will result if the hole diameter of the die, Fig. 1C, gives a loose fit for the test piece. He indicates that a specific figure for the hole diameter of the die was not given by Ollard or by Hothersall in his tests.

Roehl Modification

The adhesion value of 28.1 tons/in.^{2} reported by Hothersall (Table 1) for nickel deposited on mild steel, and considered high by Roehl, was attributed to the testing method Hothersall employed rather than to the cleaning operation. To verify the effect of dimensional variables upon adhesion, test runs were made by Roehl on samples of heat-treated steel with a tensile strength of about 120,000 lbs./in.^{2}, etched anodically in 25 per cent sulfuric acid (by weight) at 200 amp./ft.^{2}, room temperature, for 4 minutes before depositing nickel.

Results obtained show, for example, that when the hole diameter of the die was decreased from 1.030″ to 1.020″, when the hole diameter of the test

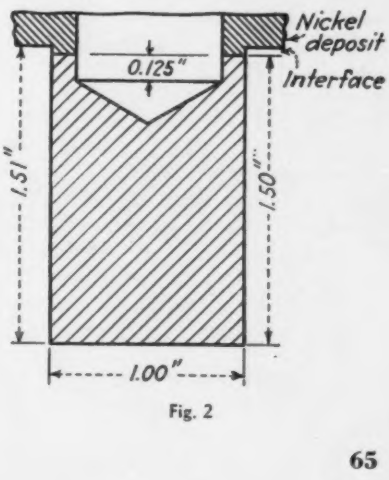


Fig. 2

TABLE 1

Examples of High Adhesion of Electrodeposited Nickel to Various Basis Metals

No.	Basis Metal	Adhesion (Ollard Value) tons/in.²	Description of Fracture
1	Mild steel	28.1	Fracture in steel.
2	Case-hardened mild steel	21.7	Failure near junction; particles of steel torn out.
3	Nickel steel forging	32.1	Fracture in steel near junction.
4	Nickel-chrome-molybdenum steel forging	21.3	Failure near junction; particles of steel torn out.
5	Brass 60:40 (extruded)	19.2	Fracture in brass.
6	Brass 70:30 (extruded)	23.7	Fracture in brass.
7	Copper (extruded)	18.5	Fracture in copper.
8	Nickel (electrodeposited and machined)	22.8	Shear in nickel cap.
9	Manganese bronze (extruded)	22.3	Fracture in bronze.
10	Aluminum (extruded and annealed)	3.5	Fracture in aluminum near junction.

piece was 0.750″ for both tests, the Ollard adhesion value increased from 14,500 psi to 33,600 psi. With an increase in the hole diameter of the test piece from 0.750″ to 0.813″, the hole diameter of the die remaining the same (1.020″), the adhesion value showed an increase from 33,600 psi to 46,300 psi. When the hole diameter of the test piece (1.030″ hole diameter of die) was increased from 0.813″ to 0.938″, an adhesion value of 22,000 psi was recorded. This value was increased to 74,500 psi when the hole diameter of the die was reduced to 1.020″. This hole diameter dimension (1.020″), accordingly, was considered most satisfactory. The nickel deposit in these tests was greater than 0.08″.

The effect of deposit thickness upon adhesion values was also investigated. Table 2 shows the results obtained for various deposit thicknesses when the hole diameter of the test piece was 0.75″ and the hole diameter of the die 1.020″. It will be noted that an appreciable increase in adhesion values results as the thickness of the deposit increases from 0.065″ (20,200 pounds psi) to 0.098″ (34,500 psi), but that only slight changes occur for greater deposit thicknesses, such as an adhesion value of 36,500 psi for a nickel deposit thickness of 0.128″. The more uniform adhesion values for the higher thicknesses are attributed to the greater resistance to shear provided by the thicker deposits. The thinner deposits folded up into cup shape.

When the hole diameter of the test piece was increased from 0.75″ to 0.938″ (the hole diameter of the die remaining the same, 1.020″), significant increase in adhesion and more uniform values were obtained (Table 3). Tensile separation of the deposits from the basis metal, in the Ollard test, is the only method considered valid by Roehl. The columns listing the ratio of shear to tension area in Tables 2 and 3 provide the data for this view. Thus, for a deposit thickness of 0.128″ (Table 2), in which the deposit failed to shear, the ratio (shear area ÷ tension area) is recorded as 1.07. This value is less than the value required for tensile separation, 1.3, the ratio representing the shear to tension area for hot rolled nickel.

When the diameter of the hole of the test piece was increased to 0.938″ (Table 3), the ratio of shear to tension area was increased and the area in tension decreased. Ratio values of shear area greater than 1.3 were then obtained, thereby permitting tensile separation of the deposit (at interface in basis metal or in the deposit) from the basis metal.

Based upon these results, modification for the Ollard test proposed by Roehl include the following specifications: diameter of the test piece hole 0.938″, diameter of the hole for the die 1.020″, deposit at least 0.090″ thick, rounded end plunger for applying load with 3/8″ diameter.

Knapp Modification

B. B. Knapp adapted a modified form of the Ollard apparatus as a quantitative adhesion test for measuring the adhesion of nickel on aluminum (alloy) sheet, with the indications that this method is effective for measuring the adhesion of many metallic coatings on sheet material.

The test was designed to measure the bond strength under a pure tensile stress when applied in a direction normal to the interface in a plated sheet material. A cross-sectional view of a specimen machined from aluminum sheet plated (on both sides) with a heavy deposit of nickel is shown in Fig. 3. A cross-section of the sheet adhesion test assembly is represented by Fig. 4. Adhesion, determined in pounds per sq. in., is based upon the breaking load and area of the bond.

Clearance between die and specimen has no appreciable effect on the results. This is clearly indicated by values recorded in Table 4. Aluminum sheet, 0.020″ thick, coated with 0.040″ nickel (from a nickel chloride bath) was tested with two dies and two

TABLE II

Ollard Adhesion Values on Steel. Variation in Deposit Thickness.

Hole Diameter of Test Piece, In.	Hole Diameter of Die, In.	Deposit Thickness, In.	Ollard Test Values, Lb. Per Sq. In.	Ratio of Shear to Tension Area
0.75	1.020	0.065	20,200	0.49
0.75	1.020	0.084	27,500	0.67
0.75	1.020	0.098	34,500	0.79
0.75	1.020	0.118	35,500	0.98
0.75	1.020	0.128	36,500	1.07

TABLE III

Ollard Adhesion Values on Steel. Variation in Deposit Thickness.

Hole Diameter of Test Piece, In.	Hole Diameter of Die, In.	Deposit Thickness, In.	Ollard Test Values, Lb. Per Sq. In.	Ratio of Shear to Tension Area
0.938	1.020	0.070	69,000	1.98
0.938	1.020	0.087	85,000	2.54
0.938	1.020	0.100	85,000	2.97
0.938	1.020	0.121	85,000	3.66

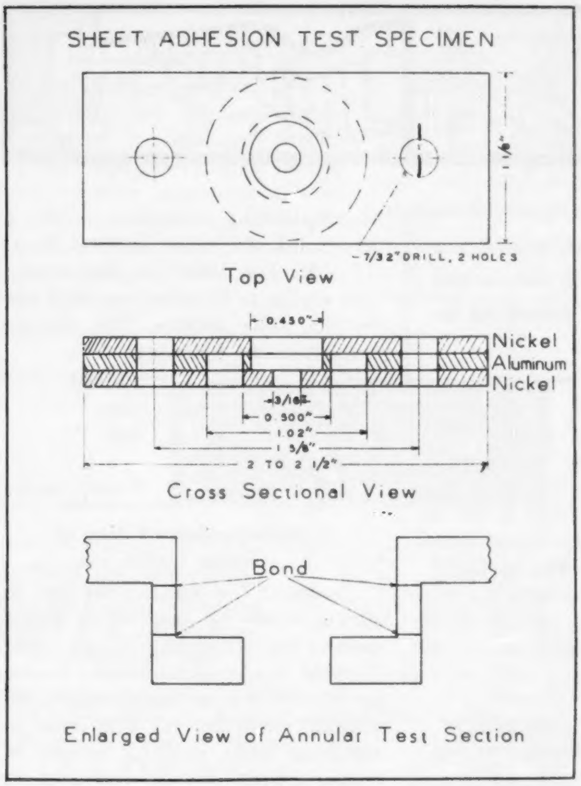


Fig. 3.

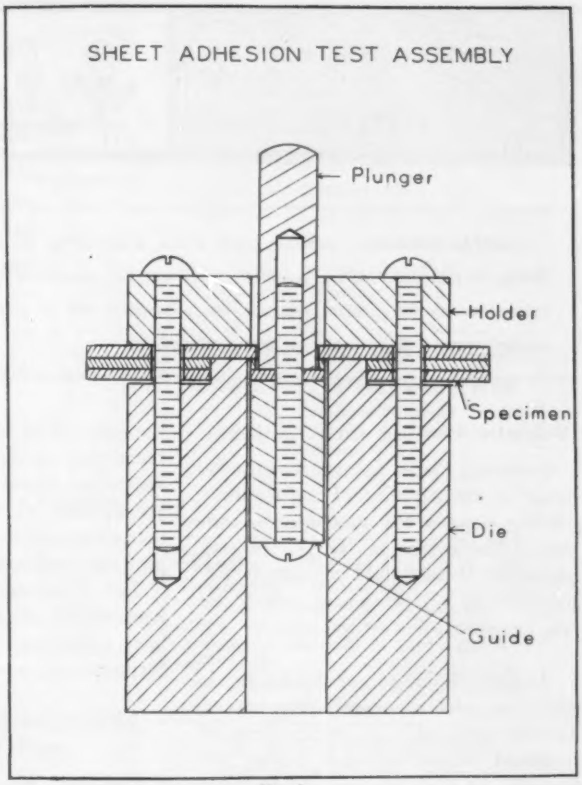


Fig. 4.

TABLE IV

Effect of Die Clearance

Aluminum sheet—3SO, 0.020" thick.
Nickel electroplate—0.040" of chloride nickel.

Clearance (inches on Diameter)		Adhesion Strength (p.s.i. x 10^{-3})				
Die	*Plunger*	*1*	*2*	*3*	*4*	*Average*
0.020	0.020	12.5	13.5	13.7	13.4	13.3
0.020	0.004	13.8	13.8	15.5	12.9	14.0
0.004	0.020	14.5	13.1	13.3	15.0	14.0
0.004	0.004	11.7	14.1	13.9	16.1	14.0

TABLE V

Effect of Nickel Deposit Thickness

Die Clearance—0.020 inch

	Coating Thickness			
Base	*Chloride Nickel*	*Watts Nickel*	*Adhesion Strength*	*Cupping*
2S Aluminum	0.015"		16,300 psi.	slight
"	0.036"		17,300 "	none
"		0.025"	15,600 "	slight
"		0.050"	17,100 "	none
Steel	0.030"		58,600 "	slight
"	0.060"		59,400 "	none

plungers with clearances in the diameter of the specimen of 0.020" and 0.004" respectively. The larger clearance permits easier machining.

The deposit, it was found, must attain a minimum thickness to maintain separation in pure tensile stress. Cupping will result if the deposit is too thin, an effect resulting in low values due to shearing stress. A nickel deposit of 0.035" from a nickel chloride bath or 0.050" from a Watt's bath is required for adhesion strengths within the range of 15,000 to 20,000 psi. Results for various thicknesses of nickel deposit for aluminum and steel basis metals are given in Table 5.

Cement Test

A. L. Ferguson and associates, in their investigation pertaining to adhesion of electrodeposits, reported that results of such tests indicate that the most favorable conditions for determining adhesion, quantitatively, would be a method employing a direct pull

Fig. 5.

(in a tensile machine) perpendicular to the surface.

The suggested use of cement for this purpose was investigated. Cylinders of brass or steel, with flat ends, ½" in diameter, ⅝" in length, were cemented together, then tested in a tensile test machine. The specimens were attached to the testing machine by the adapters, labeled A and A_1 in Figure 5. The adapters were threaded to the cement metal test pieces, B and B_1. Plated coatings were not tested.

Bond strength, it was found, depended upon such factors as cement used, metal surface preparation, cement solvents, drying and curing of the cements. The most effective preparation of the surface of the cylinder to be cemented included machining without oil, cleaning with steel wool, and degreasing with trichlorethylene. The surface was coated with cement by dipping the cylinder into the dissolved cement, then rotating the cylinder at a 45 degree angle in a motor driven device. 5900 psi was obtained.

The view is expressed by the author that, with prevention of bubble formation, without lessening tensile strength of the cement, bond strengths up to 25,000 lbs./in.^{2} should be possible.

(To be continued)

SHOP PROBLEMS

METAL FINISHING publishes, each month, a portion of the inquiries answered as a service to subscribers. If any reader disagrees with the answers or knows of better or more information on the problem discussed, the information will be gratefully received and the sender's name will be kept confidential, if desired.

Bohmite Coating on Aluminum

Question: Please furnish us with the name of the supplier of the Bohmite coating process for protecting aluminum from corrosion. Is the process patented? If not, could you supply any information or references which we can investigate?

I. M.

Answer: Böhmite, or boehmite, is not a proprietary process designation, but the name of a crystalline form of hydrated aluminum oxide having the formula $Al_2O_3{\cdot}H_2O$, the monohydrate. Thin protective films of this oxide are produced by immersion in boiling water.

Hardness of Electroless Nickel

Question: Do you have any data on the hardness of catalytic nickel-phosphorus plates, as compared with electrodeposited nickel? We have an application where wear resistance is necessary, in addition to corrosion protection, and have heard that catalytic nickel is almost as hard as chromium. If this is so, we intend to look into the matter in more detail.

H. N.

Answer: As deposited, catalytic, or "electroless" nickel has a diamond pyramid hardness of about 500-600. When heated to 750°F., the figure will increase to about 1,000 which is in the range of chromium. However, heating at higher temperatures softens the deposit, the amount of softening increasing with the phosphorus content. For example, 2 hours at 1,110°F. reduces the hardness of a deposit with 10% phosphorus from 1,000 to about 800, but reduces the 7% alloy to about 600. These figures can be compared to electrodeposited nickel, ranging from about 150 for deposits from the low pH Watts bath to almost 500 for the hard nickel bath. As will be evident from the above, the "as-deposited" electroless nickel is equivalent to hard electroplate, so that there is no improvement unless the electroless coated part can withstand heating to 750°F.

The advantage of chromium over heat-treated electroless nickel is the low coefficient of friction of the former.

Electropolishing Columbium and Tantalum

Question: We are interested in electropolishing small parts made from pure columbium and tantalum. Having contacted a number of possible sources, we were able to obtain no information except that we were referred to the METAL FINISHING GUIDEBOOK. The section on electropolishing does not deal with these metals either, which did not surprise us, in view of absence of commercial application. However, we wonder whether your files have any references on the subject, or any procedures we might experiment with.

G. L.

Answer: The few methods disclosed in the literature on tantalum employ solutions of hydrofluoric acid plus a mineral acid. Typical solutions are as follows:

1.	Hydrofluoric acid	2- 7%
	Sulfuric acid	75-98%
	Water	Balance
2.	Hydrofluoric acid	2- 7%
	Hydrochloric acid	32-38%
3.	Hydrofluoric acid	50 ml.
	Nitric acid	170 ml.
	Ammonium fluoride	30 g.
	Methanol	510 ml.

The first two baths are operated at 40-100 amp./sq.ft. and the third at about 35 amp./sq.ft.

The only reference we can find on electropolishing columbium (O. J. Krudtaa & K. Stokland. Metal Prog., **77**, 101. Jan. 1960) suggests a solution similar to #3 above, which is also by the same authors. The formula consists of the following:

Nitric acid	170 ml.
Hydrofluoric acid	50 "
Methanol	510 "
Citric acid	5 g.
Current density	5 amp./sq.cm.

Determination of Zinc in Brass Baths

Question: The March 1960 issue of METAL FINISHING suggests an EDTA method for determining copper (#55 Cyanide Copper Analysis, L. Serota, pp. 66-67). We are experiencing great difficulty analyzing for zinc metal in our brass baths, probably because of copper interference. Do you have, or could you refer us to, a source for a solution to this problem?

J. D. B.

Answer: The use of EDTA for determination of zinc in brass solutions is widespread, although the endpoint is quite fugitive. With a little practice, and rapid addition of reagent to the sample, reproducible results are obtained. The suggested procedure is as follows:

1. Pipette a 2 cc, sample of plating solution into a 250 cc. erlenmeyer flask.
2. Add 90 cc. water and 10 cc. ammonia.
3. Add sufficient solid indicator mix to produce a deep red color (1 gram Eriochrome Black + 100 grams sodium chloride). Add 10 cc. of 10% Formaldehyde (37%).
4. Titrate rapidly with standard EDTA (0.0575 molar), using strong agitation, until the deep red color changes to a light brownish pink.

Descaling Steel for Plating

Question: We are having trouble zinc plating certain heat-treated parts. Most of these parts are in rather bad shape with heat treat scale. We have been cleaning them in the plating barrel, then pickling in 50% muriatic acid.

We have had a number of people tell us how to solve this problem. Some say warm sulfuric acid with inhibitor and wetting agent and reverse current; others say the same thing, only use warm muriatic acid instead of sulfuric acid; while some recommend a descaling compound with reverse current.

We have found some heat-treated steels especially hard to plate when they are over-pickled.

If you have an answer to our problem we would certainly appreciate hearing from you.

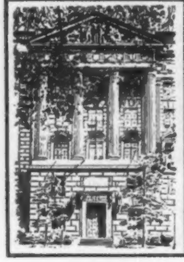
T. D.

Answer: For small parts which can be tumbled, the preferred method of scale removal is the use of an abrasive medium in a lined barrel.

For pickling with acids, hot sulfuric acid is preferable to muriatic acid because of lower cost and less fuming. In either case, an inhibitor should be added to the acid to minimize attack of the basis metal during the scale removal period. A wetting agent will reduce fuming but may form a film which must be removed prior to plating. Suppliers of inhibitors usually offer suitable wetting agents also.

Alkaline descaling is not effective for heavy scale, even with current. There would be no advantage to acid pickling with current either.

Professional Directory



Patents

RECENTLY GRANTED PATENTS IN THE METAL FINISHING FIELD

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Paint Stripper

U. S. Patent 2,940,877. *June* 14, 1960. *L. L. Jaffe and W. L. Harris, assignors to General Motors Corp.*

A paint stripping composition comprising originally an alkali metal hydroxide taken from the class consisting of sodium hydroxide and potassium hydroxide, a monohydroxy benzene taken from the class consisting of phenol, cresol and xylenol and at least one compound taken from the class consisting of glucose, gluconic acid, saccharic acid, sodium gluconate, potassium gluconate, sodium saccharate, potassium saccharate, and a disaccharide, said alkali metal hydroxide being present in amounts molecularly equivalent to from 3 to 6 pounds of sodium hydroxide per gallon of water, said monohydroxy benzene being present in amounts molecularly equivalent to about 0.3 to 0.6 pound per gallon of water, said gluconic acid, saccharic acid, sodium gluconate, potassium gluconate, sodium saccharate and potassium saccharate being present in amounts molecularly equivalent to about 0.03 to 0.6 pound of sodium gluconate per gallon of water and said glucose and disaccharide being presented in amounts molecularly equivalent to about 0.6 to 1.2 pounds per gallon of water.

Chromium Plating Crankshafts

U. S. Patent 2,940,917. *June* 14, 1960. *J. R. Dyson, assignor to Chrome Crankshaft Co., Inc.*

An anode structure for chromium electroplating a portion of a cylindrical crankshaft as same is being rotated.

Etching Aluminum

U. S. Patent 2,942,955. *June* 28, 1960. *A. Hannah, assignor to Wyandotte Chemicals Corp.*

An alkaline etching product in the range of about 2 to about 16 ounces per gallon of water, consisting essentially of (1) an alkaline etching agent selected from the group consisting of sodium hydroxide, potassium hydroxide, and mixtures thereof and being in the proportion of about 75 to 97.5 weight per cent, (2) an organic polyhydroxy scale inhibitor selected from the group consisting of monosaccharides, polysaccharides, gum arabic, gum karaya, starches, synthetic polysaccharides, polyhydroxymonobasic acids, polyhydroxy dibasic acid and mixtures thereof and being in the proportion of about 1 to 20 weight per cent and (3) an etching rate accelerator selected from the group consisting of sodium chromate, potassium chromate and mixtures thereof and being in the proportion of about 0.25 to 5 weight per cent.

Electrodeposition of Molybdenum

U. S. Patent 2,943,029. *June* 28, 1960. *C. J. Wernlund, assignor to E. I. du Pont de Nemours and Co.*

The process of electrodepositing molybdenum comprising the electrolysis with a metal cathode of a bath consisting essentially of glycerine, alkali metal hydroxide and molybdenum oxide, said hydroxide and oxide each comprising between about 1% and 12% weight of the glycerine.

Aluminum Bright Dip

U. S. Patent 2,942,956. *June* 28, 1960. *D. R. Kelly, assignor to Wyandotte Chemicals Corp.*

A finely divided composition suitable for use in aqueous solution at a concentration of about 2.8 to about 9.5 weight per cent to brighten aluminum surfaces which consists essentially of (1) about 10 to about 25 weight per cent of hydrolyzable acid fluoride salt selected from the group consisting of alkali metal bifluorides, ammonium bifluoride, sodium silicofluoride and mixtures thereof; (2) about 20 to 50 weight per cent of water-soluble organic acid with an ionization constant in the range of about 1×10^{-4} up to about 2×10^{-3}; (3) about 15 to about 30 weight per cent of water-soluble methylcellulose of a viscosity type of about 400 to about 4,000 centipoises; and (4) about 10 to about 30 weight per cent of a water-soluble, acid-stable wetting agent.

Wire Plating

U. S. Patent 2,943,030. *June* 28, 1960. *S. K. Tchejeyan, assignor to Bausch & Lomb Optical Co.*

The method of making tapered indicia for use in a reticle comprising the steps of supporting at least one wire at its ends, positioning the wire in a plane which traverses the surface of an electrolyte and depositing metal on the immersed wire by electrolytic action while continually rotating the wire in said plane about an axis coincident with approximately the midpoint of said wire and gradually varying the depth of immersion of the wire in the electrolyte whereby metal will be deposited along the wires in varying amounts to provide tapered indicia for a reticle.

Automatic Cleaning Machine

U. S. Patent 2,943,424. *July* 5, 1960. *H. M. Sadwith.*

An automatic cleaning machine for removing oil, grease or like impurities from open tote pans and from industrial parts carried therein.

Buffing Wheel

U. S. Patent 2,943,426. *July* 5, 1960. *C. F. Schlegel, assignor to The Schlegel Mfg. Co.*

A buffing wheel comprising a plurality of super-imposed helically wound layers of flexible fabric-like material each having an inner edge adapted to be received on a core and an outer working edge, said material being composed of alternating radial thick and thin bands.

Phosphating Equipment

U. S. Patent 2,943,797. *July* 5, 1960. *H. R. Neilson, assignor of one-half to Neilson Chemical Co.*

A delivery conduit terminating in a manually dirigible discharge nozzle for directing the stream flowing therefrom against and over the surface of the metal, a steam supply conduit connected to said delivery conduit for in-

PRODUCTION LINE FINISHING

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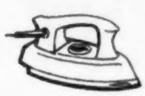
SATIN FINISHING — BURRING — POLISHING COMPOUNDS

LEA COMPOUND — industry's pioneering greaseless abrasive compositions for burring, buffing, satin finishing, and flexible polishing; contains abrasives ranging from sharp, fast-cutting grits to fine, soft powders for delicate finishes.

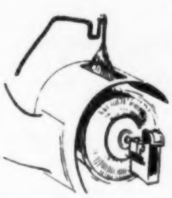
LEA PLASTI-BRADE — flexible, fast-drying, liquid abrasive, burring, polishing and satin finishing compositions, available in a wide range of abrasive grit sizes.

LEABRAMENT — greaseless, non-flammable, quick-drying, liquid abrasive for burring and polishing; can be sprayed or brushed on wheels.

BRIGHT BUFFING COMPOSITIONS

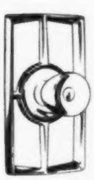


LEAROK — fine abrasive compositions with "no free grease" designed primarily for buffing or coloring pieces which involve cleaning difficulties; does not pack up in recesses and ornamentations.



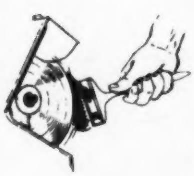
LEA LIQUABRADE — clean-working, fast-cutting and mirror-finishing liquid buffing compounds, providing in effect continuous operations and substantial economies in compositions and buffs; clean and safe, non-flammable, non-explosive; many abrasive types and grain sizes for all non-ferrous metals, steel, stainless alloys, and plastics.

LEA LAPPING PASTE — micron size controlled abrasive paste for accurate and fine surface finishing.



ADHESIVES and CEMENTS

AD-LEA-SIVE — glue-base sizing adhesive for buffing and polishing wheels to improve application of Lea Compound, or loose abrasives; available in bar form.



LEA PLASTI-GLUE — fast-drying, flexible liquid adhesive, without abrasives, for preparing polishing wheels and abrasive belts.

LEA GRIPMASTER — high bonding strength cement for polishing wheels and belts; used in setting up longer lasting polishing wheels and belts for both ferrous and non-ferrous metals.

POLISHING WHEEL and BELT LUBRICANTS

LEA LIQUALUBE — water soluble liquid lubricant for polishing wheels and belts; can be sprayed or brushed on.

LEA LUBAR — bar form lubricant for polishing wheels and belts where glazing is not a problem.

cLEAn-GRAIN LUBAR — special bar form lubricant to eliminate glazing on polishing wheels and belts.

BRIGHT PLATING PROCESSES and ADDITIVES

COPPER-GLO — Bright Copper — a proven brilliant high speed bath exceptionally tolerant to impurities.

CUPRALL — produces high speed buffable copper where brilliance is not required.

Q-LEVEL — a high speed lustrous copper process; produces excellent "hiding" characteristics. An ideal undercoat for bright nickel.

Q-STRIKE — A cyanide copper strike that produces a superior foundation for subsequent copper and nickel deposits.

PLATING ROOM ACCESSORIES

LEA ANALYTICAL METHODS — plater's short cut methods for analyzing plating solutions.

LEA LECTROMAG — portable electrical instrument for measuring the thickness of non-magnetic coatings on carbon steel and iron.

LEA KROMSAVERS — mist preventive for chrome and other plating solutions.

LEATARDENT — anti-stain dip emulsion; prevents staining and tarnishing of plated surfaces.

LACQUER ROOM SPECIALTIES

LEA COLDSTRIP — a room temperature stripper for enamels and lacquers.

LEA SYNSTRIP — high speed stripper for synthetic enamels; leaves non-ferrous surfaces smooth; no etching; especially effective in stripping epoxy resin coatings.

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Lea Mfg. Company of England, Ltd., Buxton, Derbyshire, England
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troducing a constant uniform flow of steam, a plurality of auxiliary supply conduits connected to said delivery conduit between said steam supply and said nozzle, a separate chemical-containing tank for each auxiliary conduit, a pre-set metering device between each chemical tank and said delivery conduit and means manually operable from said manually dirigible discharge nozzle for remotely operating each of said supply valves to thereby selectively deliver the chemicals from each tank into said stream in exact predetermined proportions.

Corrosion Preventive

U. S. Patent 2,943,945. *July* 5, 1960. *L. G. Saywell, assignor to Eureka Chemical Co.*

The method of making a corrosion control composition comprising heating about 1,000 pounds of wool fat to a temperature of about 140°F., adding thereto about 1½ gallons of diethylene glycol monoethyl ether and about 1 quart of an oil soluble non-ionic type detergent, adding to said mixture a slurry containing about 65 to 75 pounds of calcium hydroxide, about 60 gallons of diesel oil, and 2½ gallons of water, raising the temperature to about 165°F., adding about 60 gallons of diesel oil, heating the mixture to a temperature of about 185° to 198°F. for several hours, thereupon adding 200 pounds of pine oil, about 50 to 80 pounds of heavy fuel oil and about 140 gallons of diesel oil, maintaining said temperature for about an additional hour, adding about 4 pounds of an amine type corrosion inhibitor and 2½ gallons of dichloropentane and cooling the mixture.

Plating Machine

U. S. Patent 2,944,557. *July* 12, 1960. *D. J. Borodin, assignor to Allied Research Products, Inc.*

A work-supporting rail extending lengthwise of the tank, and means for reciprocating said rail.

Protective Coating

U. S. Patent 2,944,919. *July* 12, 1960. *L. Morris and F. Lombardo, assignors to Amercoat Corp.*

The method of producing a hard impervious coating upon a ferrous metal surface which comprises applying to said surface first (*a*) a primary coating comprising a mixture of a finely divided metal selected from the group consisting of zinc, magnesium, aluminum, manganese and titanium, and from about 10% to 40% by weight based upon said metal of an oxidizing agent selected from the group consisting of red lead and the peroxides of calcium, magnesium, and zinc, allowing said primary coating to dry, and thereafter applying on said primary coating (*b*) a curing agent for said mixture comprising an aqueous solution of a water soluble salt of a polyvalent metal, said polyvalent metal having an oxidation-reduction potential in acid solution equal to or greater than that of said finely divided metal.

Hot Galvanizing Pipe

U. S. Patent 2,944,925. *July* 12, 1960. *C. R. Lynch, assignor to U. S. Steel Corp.*

A method of coating pipe lengths which consists in immersing them in a galvanizing bath, withdrawing each length axially from the galvanizing bath upwardly along a plane inclined at a small angle to the horizontal and moving it side wise toward a tank which contains a quenching bath, dropping one end of each length into said quenching bath while continuing to support the other end of each length above the level of said quenching bath for a predetermined time, thereby permitting blow-through of vapor from the quenching bath generated by the heat of the pipe and removing from the interior of the pipe foreign matter picked up from the galvanizing bath, and subsequently dropping said other end of each length into the quenching bath for complete immersion.

Plating Bearing Shells

U. S. Patent 2,944,945. *July* 12, 1960. *P. R. Allison, assignor to General Motors Corp.*

The method of electroplating bearing shells so as to plate only one surface thereof, comprising the steps of providing a plating container having electrically nonconductive surfaces, placing a plurality of bearing shells in an end-to-end semi-sealing relationship with each other, positioning said plurality of shells in said plating container with the edges of said shells abutting opposite ends of a side of said non-conducting container surface to form a partition in said container, positioning an anode on one side of said bearing shell partition and out of contact with said shells and with said container, placing a single plate-type cathode having a width substantially equal to the projected width of said bearing shells, on the second side of said partition and out of contact with said shells and said container, filling all of said container with an electroplating bath, and finally flowing a plating current through and simultaneously agitating said bath to thereby cause limited ionic flow between the semi-sealed ends of said shells and electrodeposition on only the side of said shells facing the anode.

Plating Bearing Shells

U. S. Patent 2,944,947. *July* 12, 1960. *H. C. Luechauer, assignor to General Motors Corp.*

A method for continuously electroplating the concave surfaces of a plurality of semicylindrical bearings.

Plating Machine

U. S. Patent 2,944,953. *July* 12, 1960. *D. J. Borodin, assignor to Wagner Brothers, Inc.*

A plating machine of the type wherein rack supported work pieces are conveyed through a plating tank, the racks being suspended from carriers which are slidably supported and in electrical contact with cathode rails.

Electroformed Sheet

U. S. Patent 2,944,954. *July* 12, 1960. *R. P. Yeck, assignor to American Smelting and Refining Co.*

An apparatus for the electrolytic production of metal sheet comprising an electrolyte tank, a rotatable drum having a portion of its circumference disposed in said tank, means to rotate said drum, an anode disposed in said tank in proximity to the drum, means connecting said drum and said anode to a source of direct current, side plates for the sides of the drum, said side plates being fabricated of an electrically insulating and machinable material, yieldable means urging said plates in contact against the sides of the drum, the contacting surfaces between said plates and the sides of said drum being machined contacting surfaces, means to provide relative rotative motion between said side plates and said drum, and means on said side plates for supplying a sealant to said machined contacting surfaces.

Conveyor and Coating Mechanism

U. S. Patent 2,945,471. *July* 19, 1960. *W. L. Harrold.*

A device for conveying wire coat hangers having a hook portion, shoulder runs diverging angularly from said hook and a cross-bar connecting said shoulder runs.

Electrostatic Spray Painting

U. S. Patent 2,945,472. *July* 19, 1960. *O. Gengenbach and H. Schene, assignors to Daimler-Benz Aktiengesellschaft.*

An apparatus for electrostatically spraying objects.

Plating Machine

U. S. Patent 2,945,579. *July* 19, 1960. *J. Barton, assignor to Frederic B. Stevens, Inc.*

Apparatus for moving workpieces through a series of treating stations including a central frame, guideway means on said frame defining a closed pathway adjacent to the stations, and a plurality of vertically disposed carriage units mounted for travel on said guideway means around said pathway and outside said central frame.

Solenoid Operated Spray Apparatus

U. S. Patent 2,945,632. *July* 19, 1960. *H. A. Ball, assignor to The Cleanola Co.*

A high pressure airless spray device for applying a thin film of coating material to an object.

Conversion Coating — Aluminum

U. S. Patent 2,945,778. *July* 19, 1960. *R. J. Lipinski, assignor to Lord Mfg. Co.*

The method of improving the bondability of an aluminum surface to organic polymeric material which comprises contacting said surface with a solution, at a pH below 4, consisting essentially of a nitrosulfonic acid until said aluminum surface is visibly altered through formation of a film thereon.

Conversion Coating — Titanium

U. S. Patent 2,945,779. *July* 19, 1960. *R. J. Lipinski, assignor to Lord Mfg. Co.*

The method of improving the bondability of a titanium surface toward organic polymeric material which comprises contacting said titanium surface with a solution, at a pH below 4, of a nitrosulfonic acid and fluoride ions in an amount between about 0.1% and about 10%, by weight, based on the weight of said nitrosulfonic acid, said solution being substantially free of strong acid other than said nitrosulfonic acid, nitric acid and hydrofluoric acid in an amount to provide said fluoride ions, until said titanium surface is visibly altered through formation of a film thereon.

Waste Pickle Recovery

U. S. Patent 2,946,659. *July* 26, 1960. *C. B. Francis, assignor to Puriron and Chemicals, Inc.*

The method of producing sulfuric acid which comprises heating particulate ferrous sulfate mixed with free sulfuric acid in such proportions that the acid equals at least 17% of the weight of the ferrous sulfate on the dry basis and at such concentration that said sulfate in the resulting mixture is insoluble in the acid at 212°F., subjecting the mixture to a current of an oxygen-containing gas to a temperature above 212°F. and below that at which the acid is volatilized, thereby evaporating substantially only water and producing dry basic ferric sulfate, thereafter heating the dry basic ferric sulfate to above its decomposition temperature to produce ferric oxide and sulfur trioxide, and then reacting the released sulfur trioxide with water to produce sulfuric acid.

Plating on Titanium

U. S. Patent 2,946,728. *July* 26, 1960. *W. J. Foisel and C. R. Ellmers, assignors to Cleveland Pneumatic Industries, Inc.*

A method of providing a composite coating on an article of a metal selected from the group consisting of titanium-base alloys which comprises the steps of contacting a cleaned surface of said article with an electrolyte consisting essentially of an aqueous solution containing at least 0.02 gram per liter of trivalent chromium ions and at least 2.8 grams per liter of fluoride ions at a temperature between about 20°C. and about 80°C. and depositing chromium by chemical displacement from said solution onto said surface, removing said article from contact with said acid solution when said chemical displacement deposit has been established on the article and contacting the article as a cathode with a Watts-type nickel plating solution at a cathode density between about 10 to about 65 amperes per square foot and forming a nickel plate on said deposit.

Contact for Wire & Strip Plating

U. S. Patent 2,946,734. *July* 26, 1960. *F. P. Roy and R. L. Sallo, assignors to U. S. Steel Corp.*

A contact element assembly for the electrolytic processing of wire or strip.

Plating Printed Circuits

U. S. Patent 2,947,064. *Aug.* 2, 1960. *J. B. Langton, assignor to Technograph Printed Electronics Inc.*

In a method of metallically joining the metal layers of two-sidedly metal-clad insulation material of the type used as stock material in the manufacture of printed circuit products, wherein holes are formed through the metal-clad insulation, the step of coating the wall surface defining said holes, which comprises, exposing the said wall surface to the action of an aqueous solution composed of approximately 0.2 gram of palladium chloride and 3cc. of hydrochloric acid per liter, and then to the action of an aqueous solution composed of 2.65 grams to 15.9 grams of copper tartrate, 4.85 grams to 21.9 grams of Rochelle salt, and 9 grams of sodium hydroxide per liter in the presence of a reducing agent at a temperature in the approximate range of 70°-90°F., whereby the copper is reduced from the soluble state and deposits out as a conductive layer on said wall surface.

Immersion Tin Bath

U. S. Patent 2,947,639. *Aug.* 2, 1960. *A. R. Balden, assignor to Chrysler Corp.*

An aqueous immersion tin coating bath for aluminum and aluminum alloys consisting essentially of water, alkali metal stannate and alkali metal polyphosphate in amount between ¼ to 3 oz. by weight thereof for each 6 ounces of stannate.

Barrel Finishing

U. S. Patent 2,947,124. *Aug.* 2, 1960. *G. C. Madigan and W. W. Middleton, assignors to Bendix Aviation Corp.*

In a process for surface finishing generally foraminous articles of manufacture which are made from a prede-

termined material or materials, the steps of: selecting a liquid bath treatment which will readily dissolve some materials but which does not appreciably dissolve the articles to be finished, selecting a substance which will be dissolved by said liquid bath treatment, selecting abrasive granules which will not be appreciably dissolved by said liquid bath treatment, forming tumble finishing pellets wherein said abrasive granules are dispersed throughout a coherent matrix of said selected substance, tumbling said articles with said pellets, and thereafter subjecting the articles in which pellets become lodged during the tumbling operation to said liquid bath treatment to dissolve away the substance in the surface of said pellets to reduce their size and thereby facilitate their removal from said articles.

Anti-Corrosion Wrapping Paper

U. S. Patent 2,947,599. *Aug.* 2, 1960. *J. L. Ennis, assignor to Arthur D. Little, Inc.*

An anti-corrosion wrapping paper suitable for protecting metallic objects, said wrapping paper being impregnated with a corrosion inhibitor, said corrosion inhibitor comprising a compound of the formula

$$S\begin{cases}(CH)_{2n}\text{—}R' \\ (CH_2)_n\text{—}R'\end{cases}$$

where n is an integer selected from one and two and R' is a radical selected from the group consisting of

$$\text{—}\overset{\overset{\displaystyle O}{\|}}{C}\text{—}O\text{—}R$$

and

$$\text{—}O\text{—}\overset{\overset{\displaystyle O}{\|}}{C}\text{—}R$$

wherein R is an alkyl radical having from one to eight carbon atoms.

Porous Chromium

U. S. Patent 2,947,674. *Aug.* 2, 1960. *J. A. Andrisek and T. R. Gill, assignors to Metal Finishers, Inc.*

A method of producing a porous layer of electrolytically deposited chromium, which comprises the steps of placing a wearing member having a relatively nonporous layer of electrolytically deposited chromium in a bath consisting essentially of water, and a material selected from the group consisting of alkali metal and ammonium hydroxides and salts thereof, chromic acid, and phosphoric, sulfuric and hydrochloric acids passing an alternating current between said layer and another electrode substantially equally spaced therefrom at a density of 5 to 120 amperes per square decimeter for a sufficient time to pass 50 to 500 ampere minutes of electricity from each square decimeter of the surface of said chromium layer to provide pores in said surface, and thereafter honing said surface, whereby a wearing surface having porosity for retaining lubricating oil while having excellent hardness and wear resistance is obtained, the total concentration of material in said bath being at least .05 normal.

Work Holders for Buffing

U. S. Patent 2,948,086. *Aug.* 9, 1960. *E. F. Eger and G. W. Piper, Jr., assignors to Western Electric Co., Inc.*

In a carrier system for advancing articles past a movably mounted fabricating device, a plurality of article carriers each having selectively operable article gripping means, a trackway for guiding said carriers past the fabricating device, means actuated by movement of the carriers past the fabricating device for operating said gripping means, and means mounted on said carrier for controlling the positionment of said movably mounted fabricating device.

Plate Graining Apparatus

U. S. Patent 2,948,087. *Aug.* 9, 1960. *T. R. Caton, assignor to Reproduction Research Laboratories, Inc.*

An apparatus for applying a grain to the surface of a plate, comprising a plurality of rotatable brushes for forcing pumice against the surface of said plate to put a grain on said surface, means for holding said brushes in fixed, spaced relationship to each other and against said pumice on said plate, means for revolving said brushes together about a single axis, and means for rotating said brushes individually about substantially parallel axes, adjacent ones of said brushes being rotated in opposed directions by said rotating means, so that each of said brushes simultaneously revolves and rotates to force said pumice against said plate and the opposed directions of rotation of said adjacent ones of said brushes tends to keep said pumice on said plate.

Vacuum Metalizing

U. S. Patent 2,948,261. *Aug.* 9, 1960. *G. P. McGraw, Jr., assignor to Western Electric Co., Inc.*

An apparatus for producing printed wiring having transversely extending metallic circuit paths comprising an evacuated chamber having therein an arbor for supporting a supply of insulating material in web form, a take-up arbor for withdrawing said web of insulating material from the supply thereof, a rotative drum having elongated slots in its cylindrical wall to define a predetermined pattern of elongated slots in said cylindrical wall, said pattern of elongated slots extending circumferentially and axially along the peripheral surface of the drum, means for guiding a web of insulating material from the supply arbor to the take-up arbor over the drum for engaging and rotating the drum, a metal vaporizer within said drum for directing vaporized metal through said elongated slots onto the surface of said web to form metallic circuit patterns extending longitudinally and transversely of the web, and a second vaporizer for vaporizing another metal adjacent to the path of said web for applying a coating of said second metal on the previously applied metallic pattern on the web.

Spray Gun Cleaning

U. S. Patent 2,948,285. *Aug.* 9, 1960. *B. F. Poe and A. N. Barnes.*

In paint spray gun and painting tool cleaning equipment: a tank open at the top; a lid fittable on top of said tank, said lid having vent holes therethrough and a concavo-convex baffle plate secured to its under side, said baffle plate being dimensioned slightly smaller than the interior dimensions of the tank; a mesh platform positioned within the lower portion of said tank, having a hole positioned at its center; brackets secured to the sides of the lower portion of said tank supporting said platform; a nozzle positioned immediately below said platform and the hole therethrough, said nozzle having a hemispherical upper surface and a plurality of holes through said surface; a compressed air supply line from a source of compressed air to the said nozzle; a solvent reservoir formed by the lower portion of said tank below said mesh platform and below said nozzle; a solvent supply line

from said solvent reservoir to the nozzle; and an air filter between the tank and the source of compressed air.

Rust Preventive

U. S. Patent 2,948,598. *Aug.* 9, 1960. *A. E. Brehm, assignor to Standard Oil Co.*

A composition consisting essentially of a major proportion of a normally liquid non-lubricating mineral oil fraction, from about 0.0001% to about 1.0% of a polymeric high molecular weight unsaturated carboxylic acid having a molecular weight above about 300 selected from the group consisting of dilinoleic acid and polymerized castor oil fatty acids consisting essentially of from about 45% to about 55% of a monomer and dimer fraction having a molecular weight of from about 300 to about 600 and from about 45% to about 55% of a trimer and higher polymer fraction having a molecular weight in excess of about 600, and from about 0.0001% to about 1.0% of a perfluoroalkyl surface active agent having the general formula

$$C_nF_{2n+1}CONHC_{n'}H_{2n'}N(C_{n'}H_{2n'+1})_x(C_{n''}H_{2n''+1})_yZ_z$$

in which *n* is an integer 6 to 10 inclusive, *n*' is an integer 1 to 3, *n*" is an integer 1 to 12 inclusive, *x* is an integer 2 to 3, *y* is an integer 0 to 1, Z is a halogen selected from the group consisting of bromine and iodine, and *z* is an integer 0 to 1, said polymeric acid and said perfluoroalkyl surface active agent being employed in the ratio of 2:1 to 1:2 respectively.

FOREIGN LITERATURE

Chromizing of Steel

J. S. Insausti: *Instituto Hierro y Acero* (Spain) **9,** No. 44, 250-257.

A description and details are given of a chromizing treatment worked out at the Institute to which the author is attached. The objective was to develop a working technique characterized by maximum simplicity and with reasonably low working costs. Details are given of the preparation of the chromizing mixture and of the boxes used. The formulations to obtain the best results are discussed. The reactions are considered and consideration is given to the carrying-out of the operations so as to obtain parts which are free from or else only show a minimum of distortion. Other points about which the author gives details are the diffusion of the chromium in the steel, the structure and uniformity of the coatings obtained, the quality of the surface finish and the main pretreating conditions so as to obtain good coatings.

Finally, certain influencing features are discussed, such as the factors governing the thickness of the coating, the influence of the carbon content on the quality of the coating, and the optimum temperature for various carbon contents of the steel.

Electropolishing and Chemical Polishing of Copper and Copper Alloys

Metalloberflaeche, **14,** No. 6, 183-184.

Electropolishing baths for copper and brass, are formulated mainly on the basis of mixtures of phosphoric acid with chromic acid or butyl alcohol. The use of these baths for large-scale production work is limited, however, by the fact that the best effects can only be obtained under very-strictly-controlled operating conditions. A further drawback is that the layout and equipment for suitable processes are fairly costly.

The first chemical polishing bath developed was the well-known phosphoric-acetic-nitric acid type. This bath worked at 60-70°C. The chief disadvantage is the instability of the solution and short-life. This is a phenomenon of many bath solutions containing acetic acid, working at elevated temperature. A further disadvantage is the high metal removal of around 25 to 40 microns, as well as the generation of noxious vapors. It is stated that these disadvantages are overcome partially by a bath of the following composition:

Phosphoric acid	40 cc.
Nitric acid	15 "
Water	48 "
Hydrochloric acid	1.5 "
Ammonium nitrate	20 g.

The advantages of this bath are the lower concentration and consequent economy. It is worked at 35°C. and, with a dip-time of 3-4 minutes, removes 12.5 microns of metal. The solution has steady working characteristics and the bath can be used up to 300 g./l. of metal. It is then regenerated by addition of nitric acid and water.

A disadvantage is the fact that it is necessary to work as a 2-bath process because the chemical polishing bath leaves an adherent, visible film on the metal (apparently copper oxide). This film can be removed in a clearing bath of the following composition, at room temperature and with a dip-time of 10 seconds:

Phosphoric acid	30% by vol.
Glacial acetic acid	65 " " "
Nitric acid	5 " " "

This solution has a short life. However, for subsequent nickel and chrome plating, it can be replaced by a bath consisting of a 5% solution of sulfuric acid, which removes the film sufficiently to ensure satisfactory plating adhesion.

A new type of chemical polishing bath for copper and brass has been developed jointly both in Germany and England. With this bath, a part of the phosphoric acid is replaced by arsenic acid (H_3AsO_4) by which a better polishing effect is obtained and only one bath solution is required.

Action of the Polishing Compounds on Surface Brightness in Barrel Polishing

M. Dreher: *Galvanotechnik,* **49,** No. 5, 188-194.

Apart from the purely mechanical factors which act on polishing by means of the chips in a polishing barrel (barrel diameter, speed of rotation, polishing duration etc.), the chemical factors play a prominent part with regard to the polish obtained. These factors are as follows.

Firstly, so as to avoid the creation of an electrical potential between the component parts to be polished and the polishing barrel, it is preferable that the latter should not be constructed of metal but of wood. The wood should be dry and free from resin and acid.

The water employed should be free from minerals as much as possible. The parts to be polished can be classified into groups. Thus, for example, the copper alloys, steel alloys, stainless steels, precious metals, and light metals all require different treatment.

The surface of the metal parts to be polished should be clean and free from chemical compounds such as oxides and sulfides. As pickling is often used

before polishing, it is necessary to avoid pickling bath residues by carefully rinsing the parts before introducing them into the polishing barrel.

The polishing compounds are not a universal cure-all. They must be adapted to the parts to be polished. However, certain characteristics are required of all polishing compounds. These are: the gliding power, foaming characteristics, and emulsifying power. Moreover, these compounds should not attack the parts to too great an extent and should have no chemical action on the chips. The compounds should be easily eliminated by rinsing, without leaving residues or spots.

Chemical Polishing of Aluminum

Galvano (Paris), **28,** No. 268, 236-238.

The principal use of chemical polishing of aluminum is prior to anodizing. Two types of polish can be obtained by this method:

1. A very enhanced finish of the specular type, obtained by the employment of two baths with a slow action, containing more than about 70% of phosphoric acid and which is suitable for surfaces which have previously been given a mechanical polishing;

2. A bright surface finish which is characterized by a lower specular reflectivity than that offered by surfaces which have been mechanically polished but which is nevertheless satisfactory for the production of bright parts, processed by electrolysis and dried. In this case, baths with a rapid action can be used, containing only 40 to 65% phosphoric acid. It has been found that shorter durations of anodizing treatment suffice to obtain the same thickness of film. This fact is associated with the greater diffusion of chemically polished surfaces. In addition, after the coatings are dyed, sharper colors are obtained.

The majority of chemical polishing baths in use contain phosphoric acid as the basic ingredient, with additions of nitric, sulfuric and acetic acid. Although phosphoric acid used alone is capable of polishing aluminum at 80°C. and, although the combination of phosphoric-sulfuric acid is a cheaper formulation, the best results are obtained with baths containing nitric acid.

In practice it is found that the polishing baths using the combination phosphoric-nitric acid give a total reflectivity of 87% in white light, on a commercial grade of aluminum. Reflectometer measurements have given slightly lower measurements for the aluminum-manganese alloys and for alloys containing magnesium. The polishing bath is operated at a temperature of about 90°C.; immersion is for 15 seconds to 5 minutes, according to the initial surface condition. A typical bath formulation of this type is as follows:

Phosphoric acid	80.5% by vol.
Nitric acid	3.5 " " "
Water	16.0 " " "

With the phosphoric - nitric - acetic acids bath, the concentration is not regarded as too critical. The normal use of up to 15% of water in this bath can be dispensed with; good results are obtained in its absence with an operating temperature of 85-95°C.

In the case of the phosphoric-sulfuric-nitric acid baths, an extended range can be used. The baths with an increased content of sulfuric acid have the characteristic of rapidly smoothing-down rough surfaces. However, these baths are suitable only for aluminum with a purity exceeding 99.5%.

To increase the speed of attack, to use a lower operating temperature and a higher water content, nickel and cobalt salts are sometimes added and, to a lesser extent, zinc and chromium salts.

Universal Electrolyte for Electropolishing of Stainless Steels, Low Carbon Steels and Titanium Alloys

G. I. Parfessa and V. A. Sidlyarenko: *Avtomaticheskava Svarka* (Russia), **11,** No. 7, 83-84.

Details are given of the development of a universal electropolishing technique applicable for the joint seams of various types of steel, etc. The principal factors governing the quality of the polish are discussed and the compositions of the electrolytes employed, are given. Operating details such as the bath voltage, current densities and spacing distance between anode and cathode, are given. Finally, discussion is made of the results obtained with the techniques outlined.

Technical Possibilities of Electroless Nickel Coating Methods

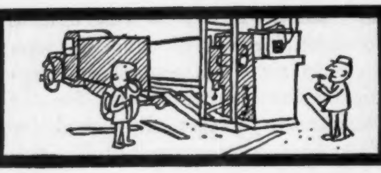
J. L. Fiedler and J. J. Vanroyen: *Revue du Nickel* (France), **24,** No. 3, 53-63.

Chemical reduction of nickel salts has been known for over 100 years but it is only within the last 12 years or so that the process has achieved any commercial importance. Hypophosphites are capable of depositing metallic nickel from solutions of nickel salts by means of reduction. The first patent covering this process was taken out by Brenner in the U.S.A. Examples of electroless nickel baths in commercial use are listed below.

These baths are normally applied for the production of thin coatings on surfaces of a small area.

One difficulty with the electroless nickel processes is the maintenance of the bath and the regeneration of spent baths. Particularly with continuous flow production, it is necessary to maintain the bath composition as reasonably uniform as possible, to ensure uniform working and metal coating conditions. To some extent this has been achieved, but certain difficulties still remain to be overcome.

	Bath Type		
	Alkaline Bath for Nickel, g./l.	*Acid Bath for for Nickel, g./l.*	*Cobalt Bath g./l.*
Nickel chloride	30	30	—
Cobalt chloride	—	—	30
Sodium hypophosphite	10	10	20
Sodium citrate	100	—	35
Sodium hydroxyacetate	—	50	—
Ammonium chloride	50	—	50
Alkali pH	NH_4OH, 8-10	NaOH, 4-6	NH_4OH, 9-10
Deposition rate — microns/hour	7.5.	15	15



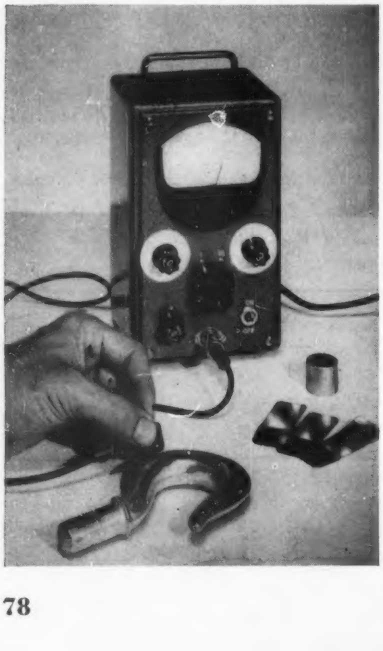
Non-Destructive Thickness Tester

Twin City Testing Corp., Dept. MF, 533 S. Niagara St., Tonawanda, N. Y.

Type ES Permascope provides a non-destructive means of measuring thicknesses of organic and non-magnetic metal coatings (including phosphate) on iron and steel with the accuracy of the microscopic method, it is claimed.

A compact, portable unit measuring 5¼" x 8¾" x 5", and operating on 110 volts AC, it features a small, 2-pole probe which works on the principle of a magnetic amplifier. To measure the thickness of a coating, the probe is simply applied to the surface. A closed magnetic field is created between the poles of the probe with the lines of force largely contained within the basis metal. The thickness is accurately indicated on one of the direct-reading scales of the instrument. Model ES le 2 J4a has two scales with ranges of 0-0.001" and 0.0008"-0.010". Model ES le 3 J4a has three scales with ranges of 0-0.001", 0.0008"-0.010" and 0.008"-.0.100".

Four probes are available for measuring thicknesses up to ¾". A special attachment can be furnished for applying the probe at constant pressure to soft materials as well as to small diameter wire. Other accessories include a holding fixture for measuring plating thicknesses on piston rings and an attachment for gaging coatings on the inner walls of tubing, pipe and cylinders (with min. I.D. of 11/16") at any point within the bore, regardless of depth.



Corrosion Preventive for Die Castings

Northwest Chemical Co., Dept. MF, Roselawn Ave., Detroit, Mich.

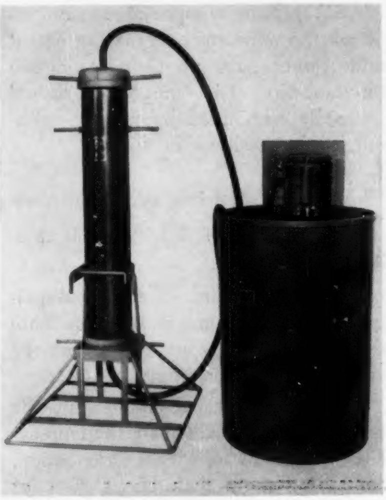
A special die casting quench is claimed to eliminate scumming, foul odor, chip and dirt flotation and blistering rejects due to water corrosion. The product, called Four Star Quenching Compound, is usable for both aluminum and zinc castings. It requires no heating, special tanks or equipment, won't turn rancid, remains stable under production heat build-up and retains its efficiency over many die changes, thus effecting substantial replacement economies.

The material leaves a water repellent residue too thin to affect accurate gauging but which prevents oxidation of parts held in storage as long as three months and prevents water oxidation of parts exposed to the elements while awaiting plating. Parts quenched by this method do not require blow-off of redeposited chips and soil after removal from the bath as there is no blanketing foam or scum at operating temperature. Cleaning of castings prior to plating is greatly simplified and bacteria, dermatitis and odor are eliminated.

Gold Recovery Unit

Technic, Inc., Dept. MF, P.O. Box 965, Providence, R. I.

The Gold Saver, designed to become part of the acid or non-cyanide gold plating process, basically, consists of a column of special resin, which captures gold in solution that now is being lost, a pump for circulating through the resin column the water in which the gold is dissolved, and pipes, hoses, and connections between the pump and the special resin column.



The unit is attached to a tank into which the plated item is dipped. after the drag-out tank. The pump continuously circulates the solution through the special resin trap, where the gold is picked up. The work, free of gold, is then rinsed in running water. When the resin is completely saturated with gold it may be burned by the plater to recover the gold, sent to a refiner, or it may be returned to the manufacturer's laboratories for reclaiming.

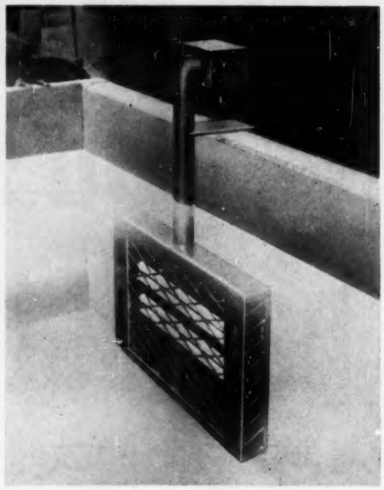
Roof Ventilators

Heil Process Equip. Corp., Dept. MF, 12850 Elmwood Ave., Cleveland 11, Ohio.

Solid plastic roof ventilators for removing corrosive fumes provide an upblast discharge, which blows the fumes high into the air, minimizing corrosion to nearby roofs and ground areas, and reducing chances of fumes re-entering the plant. All exposed parts including the housing and impeller are built of Rigidon plastic. Ten standard sizes range from 400 to 15,000 c.f.m.

Quartz Immersion Heater

Electrical Accessories Co., Chemical Equipment Div., Dept. MF, 744 Broad St., Newark 2, N. J.



The Heat-Pak unit comprises one or more completely submersible sealed elements of fused quartz or metal, operating independently of each other. Elements are mounted in a compact rectangular cage or holder that fits between the anode bars and sides of plating tanks. The submerged elements are mounted horizontally to provide maximum exposure of the heating surface. Elimination of internal cores of quartz heaters reduces initial heatup time, and avoids undesirable surface temperatures detrimental to the solution. Elements are always located well below the liquid surface, yet have ample clearance at the tank bottom to avoid sludge deposits. This eliminates operational failure through liquid evaporation or deposit accumulation on the elements.

According to users' needs, each unit can be equipped with one to four elements of 1,000 or 1,500 watts each, giving a wide range of wattage up to a total rating of 6,000 watts, in increments of 500. The ingenious design of the element assemblies permits efficient heating to be obtained with low watt densities (20 watts per suare inch for the 1,000 watt assemblies, 30 watts per square inch for the 1,500 watt elements).

Alkaline Cleaner

Kelite Corp., Dept. MF, 81 Industrial Road, Berkeley Heights, N. J.

No. 25E is a dustless powdered composition capable of removing difficult oily soils, fatty soils, and greases from

hard surfaces. It is a non-caustic alkaline cleaner that exhibits cleaning efficiency only attained previously by heavy-duty highly alkaline compositions. Solutions have the ability to penetrate and deterge both oil-wettable and water-wettable soil. Further, the product is safe and non-toxic to personnel under normal conditions of use.

Superior cleaning efficiency, through the use of a new synergized surface active system, is obtainer without attack on sensitive substrates such as organic finishes, aluminum alloys, brass, and other copper alloys. The product, which dissolves readily at ambient temperature, exhibits high soil removal efficiency at moderate pH.

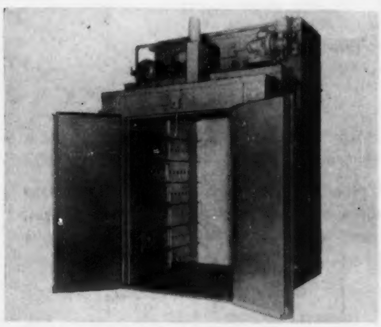
Versatile in respect to applications, it can be used in water solutions as a safety solvent for hard surface cleaning, as a steam cleaning composition, or as a hot tank immersion soak product.

Batch Ovens

DeVilbiss Co., Dept. MF, Toledo, Ohio.

Batch type production ovens, assembled from stock components which offer flexibility with economy, are delivered either assembled or ready for assembly. The ovens are easy to install and can utilize steam, gas or electric heat. Loading is accomplished by means of stationary racks, trays, trucks, or hand-operated monorail conveyors.

Constructed for severe service and maximum efficiency, these batch ovens feature insulated panel construction, with the insulation compressed between 20 gauge mild steel to prevent sagging. Stiffening channels provide panel rigidity and are perforated for a minimum of "through metal" in the oven wall. The double doors have the same high insulating value as the panels and are provided with easy acting hinges and explosion relief latches. The 14



Now-28 ISOBRITE® PLATING BRIGHTENERS

For Zinc, Cadmium, Copper and White Brass

HAVE THE *FOUR* BIG FEATURES YOU ASKED FOR!

When the Allied line of brighteners, now known as ISOBRITE, had the famous ARP trademark on them, we made a survey to find out exactly what *you* wanted most in brighteners. Your answers helped guide our research and development staff in evaluating and consolidating our new line.

Now, here are the results—the industry's most complete line—28 *ISOBRITE Brighteners with these most-wanted features:*

1. LONGER LIFE

Your own records will show ISOBRITE Brighteners give longest possible life in rack or barrel plating operations.

2. BRIGHTNESS

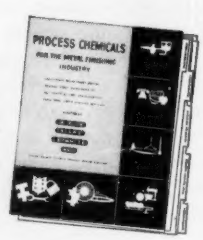
You'll see for yourself that ISOBRITE Brighteners give a diamond-like sparkle that just can't be matched.

3. THROWING POWER

Even if your product has deep recesses, you'll get a uniform, all-over brightness that only ISOBRITE Brighteners can give you.

4. WIDER BRIGHT RANGE

ISOBRITE Brighteners operate efficiently over exceptionally wide current density ranges and have greater tolerance for temperature change.



Remember, there's an ISOBRITE Brightener especially designed for your specific operations—whether you're rack or barrel plating zinc, cadmium, copper or white brass . . . an ISOBRITE Brightener that is entirely compatible with most other brighteners. Don't just order brighteners—specify ISOBRITE. There *is* a difference!

Your Allied Finishing Systems Engineer will be glad to discuss the benefits of ISOBRITE Brighteners in your operations. He's listed in your 'phone book under "Plating Supplies." Or, write for technical data and product list giving details of your operations.

Allied Research Products, Inc. 4004-06 EAST MONUMENT STREET • BALTIMORE 5, MARYLAND
BRANCH PLANT: 400 MIDLAND AVENUE • DETROIT 3, MICHIGAN
West Coast Licensee for Process Chemicals: L. H. Butcher Co. • European Agent: Sture Granberger, Storgatan 10, Stockholm, Sweden

Chemical and Electro chemical Processes, Anodes, Rectifiers, Equipment and Supplies for Metal Finishing

IRIDITE® Chromates | IRILAC® Coatings | ISOBRITE® Brighteners | ARP® Supplies | WAGNER Equipment

gauge mild steel floor will withstand wear and keep oven panels in alignment. An insulated floor is also available.

A circulating fan provides uniform heat distribution, moving it from one side of the oven to the positive exhaust system on the other side. Adjustable, multiple perforations enable closely controlled circulation with varying loading conditions and types of work.

All controls are mounted, all piping is complete to one line for easy connection, and all electrical wiring is complete in the prefabricated ovens.

Compressed Air Filters

King Engineering Corp., Dept. MF, P.O. Box 735, Ann Arbor, Mich.

A line of compressed air filters that remove practically 100% of the entrained dirt, oil and water from the air and normally operate for months without maintenance, has maximum flow rates from 20 to 200 standard cubic feet per minute, in pipe size ranges from 1/4" to 2".

These filters employ a new operating principle that gives the air a scrub-and-polish treatment. The scrubber cartridge is saturated with liquid at the factory to start the coalescing action, and its operation depends on its being saturated. Thus this cartridge is not replaced when wet with oil and water removed from the air, but keeps right on filtering. The down-flow of air continuously sweeps it clear of excess liquids. The scrubber cartridge does 98% of the cleaning, so the polisher cartridge also lasts for many months.

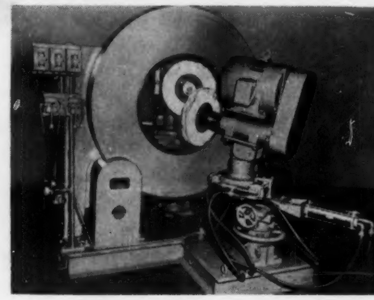
Both cartridges are disposable. Replacement of exhausted cartridges restores original filter performance, and an unskilled workman can do the job. Their small size and sturdy construction makes it practical to keep ample spare cartridges in stock. One standard size fits all filters.

Wheel Rim Polisher

Acme Mfg. Co., Dept. MF, 1400 East Nine Mile Road, Detroit 20, Mich.

A new semi-automatic polishing and buffing machine for finishing bicycle wheel rims consists of a heavy duty rotating work holding fixture and two L-8-L fully adjustable lathes.

The rotating work holding fixture consists of a series of clamping segments, actuated by an air operated scroll. This arrangement insures proper



concentricity of part and adequate holding pressure. Because of the heavy duty construction of the work holding fixture the lathes can be utilized for high pressure polishing or buffing operations to help reduce finishing time. Production rates can vary from 60 to 120 polished or buffed rims per hour depending on the specific application.

Each of the lathes on this machine is equipped with manual adjustments to raise and lower and provide in and out positioning of the polishing or buffing wheels. In addition, a tilt adjustment for setting the wheel spindle angle and a 360 degree horizontal swivel adjustment is provided on the heads.

The lathes are adapted with an air cylinder arrangement which automatically pivots the heads "in" for finishing operations and "out" to facilitate loading and unloading operations.

A timer controlled air cylinder arrangement can be incorporated on this machine which could be pre-set for a desired finishing cycle time, thereby insuring uniform finish quality at maximum production rates.

The rotating work holding fixture is powered by a ¾ hp motor and the lathes are driven by 7½ hp motors. The machine occupies a floor space of approximately 6 ft. x 6 ft. and is 6 ft. high.

Conversion Coatings

Pennsalt Chemicals Corp., Dept. MF, Three Penn Center, Philadelphia 2, Pa.

A new chemical surface treating process, which for the first time color coats all types of metals in a single treatment, produces coatings in several grades, clear and colored, which are corrosion resistant, have good weathering properties and are color fast. The process combines ease of application with good corrosion resistance at economical cost. The coatings can be applied readily to practically any metal,

producing attractive satin and color finishes. In addition to being resistant to acids, alkalies and solvents, color coatings are considerably more economical than color anodizing or painting.

Coatings are applied in aqueous solution at room temperatures. A low viscosity solution which covers completely, drips free quickly with virtually no carry over, it can be applied by roller coating, dip or spray. The only pre-treatment required is thorough cleaning and rinsing, as would be done in any finishing system. Curing time can be as little as a few seconds, depending on the heat source.

Hinac-1 is equal or superior to blackplate in corrosion resistance and can be substituted for organic finishes. Carbon steel, stainless steel, aluminum and zinc plated steel coated with this grade can be welded better than untreated metal.

Hinac-2 is a heavier grade, providing excellent protection for ferrous and non-ferrous metals. Aluminum and stainless steel coated with this grade have good resistance to salt spray and have good outdoor weathering properties.

Color Hinac, available in a hard, solvent resistant grade and a ductile grade, provides both under-film corrosion resistance and attractive, lightfast color. Applied to aluminum, zinc, carbon steel, stainless steel, magnesium and other metals, the finishes are hard, durable and resistant to salt spray. When exposed to Florida sun for a full year and 2000-hour weathermeter tests, coated metals exhibited good weathering, fade resistance and gloss retention. Colors include red, brown, green, blue, black, gray and bronze.

Airless Spray Gun

Gray Company, Inc., Dept. MF, Minneapolis 13, Minnesota.

Two major improvements in the above manufacturer's airless Hydra-

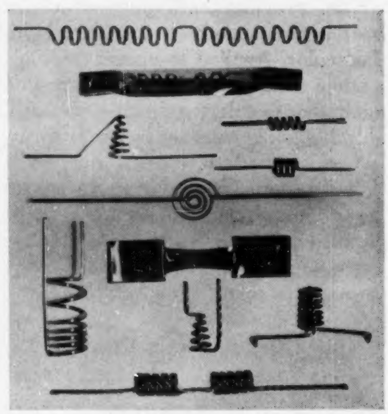
Spray process now permit the controlled application of a wider range of viscosities and mil thicknesses. The "Golden" Gun now features a shorter over-all length with center balanced weight and a swivel at the base of the handle that allows greater maneuverability in coating flat or intricately shaped surfaces. The improved design also features a lighter trigger pull and quick pop-action shut off which improves finish quality by increasing film control.

The "FF" fine finish tip provides an excellent lapping pattern which makes it possible to apply an even-mil thickness suitable for precise final finishes on furniture, appliances, automobiles and similar products.

Vacuum Metalizing Filaments and Boats

Electronics Div., Allen-Jones, Inc., Dept. MF, 1345 Gaylord Ave., Long Beach, Cal.

A new complete line of tungsten, tantalum and molybdenum filaments and boats is now available in a variety of sizes and shapes. Manufactured for use in high vacuum as an evaporation source, these filaments and boats are processed to maintain a new high



standard of purity and accuracy. All parts are stress relieved to obtain the longest possible life in operation, and to maintain their geometry during use.

Rectifiers

Ramm Rectifier Co., Inc., Dept. MF, 527 Faile St., Bronx 59, N. Y.

Model HC6-800 offers a wide variety of low ripple, voltage and current ranges. Variation in voltage and current output is accomplished with simple operations on the front panel of the unit.

Input: 220/440, 3 phase, 60 cycle, plus or minus 10%.

Output: 3-6 volts @ 800 amperes; 6-12 volts @ 400 amperes; 12-24 volts @ 200 amperes.

Ripple: Less than 2% RMS in all ranges.

Semi-Conductor: selenium/silicon.

Cabinet: 55" H. x 24" W. x 21" D., mobile.

Control: 24 positions.

The units are also available in a wide variety of voltage and current ranges.

Fluoborates

Harstan Chemical Corp.., Dept. MF, 1247 38th St., Brooklyn 18, N. Y.

Fluoboric acid, tin, lead, copper, nickel, and numerous other metallic fluoborates for the plating industry, are now available from the above manufacturer.

The fluoborates provide simple maintainance, excellent covering power, 100% efficiency and are available in a liquid concentrate solution. Free literature and samples available on request.

Mobile Sump Filter Pump

Sethco Mfg. Corp., Dept. MF, 2284 Babylon Turnpike, Merrick, N. Y.

The mobile sump filter system is leakproof, self-priming, and designed for trouble free filtering of 50 to 600 gallons of solution hourly. It can be moved over irregular floors and maneuvered into narrow quarters, on its portable stainless steel cart mounted on two 8" rubber tire wheels. Since it can be raised, lowered, and tilted readily, it can be used to filter tanks from approximately one foot below floor level up to a height of four feet.

The portable stainless steel carts,

MC-1, are also available as optional equipment for incorporation into existing filter models UAL-5, 10, 20, 30 and 40.

Vacuum Metalizer

NRC Equipment Corp., Dept. MF, 160 Charlemont St., Newton 61, Mass.

Electron bombardment heating sources have been adapted to standard and special vacuum coaters for research into the evaporation of ultra-pure metals and alloy systems, as well as for depositing high temperature materials such as zirconium, tantalum, and tungsten.

According to the manufacturer, any of its standard coaters can be supplied with electron bombardment evaporation sources. However, the most popular units are expected to consist of standard Model 3144 coater with an electron beam gun or annular ring being used as the heating source. Evaporation paths can be controlled by the relative position of the gun and of the metal to be evaporated. The latter can be mounted either as an ingot or button on a copper, water-cooled support. The gun can be located either on top or on the side of the chamber and is rated at up to 6 KW. A variety of power supplies are available to meet customer requirements. The coater is available with either an 18-inch or 24-inch mild steel or stainless steel bell jar. It is equipped with a new high-speed, 6-inch fractionating diffusion pump that is said to have the highest capacity and lowest backstreaming rate in the industry. Rotary gas ballast mechanical pumps of 15 to 30 cfm rating are used for rough pumping and back-up, depending on performance requirements.

Immersion Copper Process

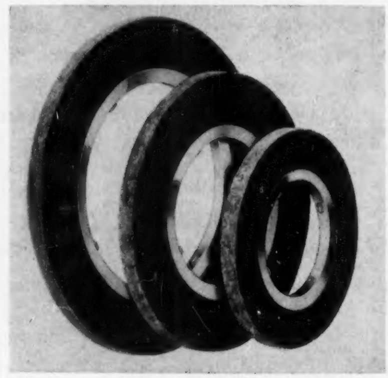
Amchem Prod., Inc., Dept. MF, Ambler, Pa.

Cuprodine No. 5 is a further development in non-electroplated copper coatings, which provides increased coating adhesion and efficiency and greater uniformity of color over previous sulfuric acid-copper sulfate formulations when applied to carbon and stainless steel wire and stampings. The thin, adherent copper coating acts as a lubricant on the steel to appreciably reduce scratching of the wire, pickup and wear on dies.

Power Brushes

Osborn Mfg. Co., Dept. MF, 5401 Hamilton Ave., Cleveland, Ohio.

Available in wheel diameters of 4″ to 12″, the new Master Blend power brushes combine the efficiency of blended, straight wire cutting points, encapsulated in a plastic bond to precisely control finishing action. Because



of the precisely controlled cutting action, peening or rolling of metal edges is kept to an absolute minimum and, in many cases, is entirely eliminated.

Operating techniques are the same as with any precision industrial tool. Careful set-up and pressure control will be necessary to achieve maximum results from the new tools. They are highly effective on all types of polishing lathes, rotary indexing machines, inline machines, and other equipment.

Non-Pitter

Angler Chemical Co., Dept. MF, P.O. Box 173, Plainville, Mass.

A light amber thick liquid jellied type compound, #515-B Hi-Brite Non-Pitter, can be applied directly on to any abrasive or burnishing material generally used.

The product is applicable in every stage of the finishing operation, according to the manufacturer. It can be

used in bright finishing of steel and stainless steel in barrel finishing operations; and also has the ability to remove light rust and give extended layover protection and rust prevention.

The compound should be handled with reasonable care, as it contains some heavy alkaline compounds and has a pH of 13.5. To prevent pitting, 3 to 4 oz. are used to each 20 gallons of water in each stage of finishing.

Graphite Drain Valve

Falls Industries, Inc., Dept. MF, Solon, Ohio.

This new line of drain valves provides almost universal corrosion resistance because all valve internals are machined from Impervite impervious graphite, which is unaffected by the action of all corrosives except a few highly oxidizing agents. In addition, the manufacturer claims the material is immune to effects af thermal shock, and will not crack or chip.

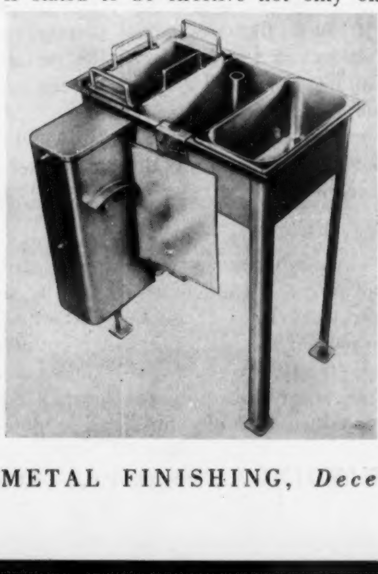
The valves use a piston closure, without seats. Consequently, this valve cannot be over-tightened. The piston is extendable into the vessel to be drained, and piston position is externally indicated for convenience and safety. Standard ASA flanges are employed for convenient mounting; heavy duty ball bearings are used on a stainless steel piston spindle; and the piston packing utilized is Teflon chevron rings. Cast-iron bodies are used on all sizes.

Valves are available in 2, 3, 4, and 6 inch sizes; suitable for use at temperatures to 340°F., at pressures to 150 psi.

Metal Parts Cleaner

Pall Corp., Dept. MF, 30 Sea Cliff Ave., Glen Cove, N. Y.

The Metal Parts Chemical Cleaner is stated to be effective not only on



parts of simple configuration, but is equally applicable to parts which have unusual or convoluted shapes, such as the inside of tubing and small holes in complex shapes. The new cleaner is superior in cleaning ability to other systems including most commonly used ultrasonic equipment, it is claimed.

Stainless steel, brass, aluminum, carbon steel, nickel and nickel alloys and other materials can be finished to a bright surface. The cleaner will remove encrusted carbon, weld oxides, brazing flux, varnish and paint. Cleaning is performed with Pall-Clean solutions which contain effective chemicals and detergents.

Complete instructions are attached to each unit, which contains no moving parts or electric tubes. Operation of the cleaner requires little or no special training of operators.

Matte Finish for Aluminum

Frederick Gumm Chem. Co., Inc., Dept. MF, 538 Forest St., Kearny, N. J.

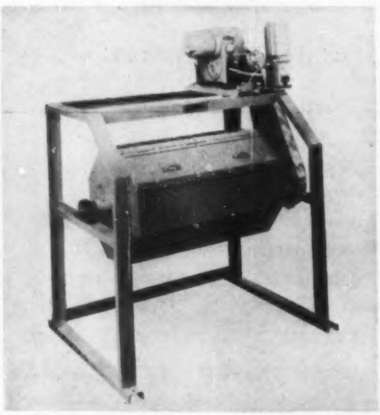
Wrought and extruded aluminum-alloys can be treated in the Clepo Sat-N-Mask process to obtain an extremely white matte finish. The surface makes an excellent contrast when used in conjunction with polished finishes and is widely applicable in the decorative field where aluminum is utilized.

The simple dip process masks surface scratches and extrusion lines, thereby eliminating costly polishing operations prior to anodizing or lacquering.

Barrel Finishing Units

Tumb-L-Matic, Inc., Dept. MF, St. Marys St., Stamford, Conn.

Designated as Type LS, this new line incorporates barrels which range in size from 21" in diameter and 20" long to 30" in diameter and 48" long with either single or double compartments.



The machines include, as standard equipment, welded channel iron framework, octagonal patented sheet steel barrels with hard maple liners, guarded chain drive, variable speed motor, unloading tray and screens and removable door with quick opening latches.

Optional equipment available includes loading hopper and unloading chute, expanded metal screen enclosure on both ends and rear, safety door providing limit switches interlocked with control system, magnetic brake on extended motor shaft and electrical push-button brake release.

Definning equipment for deflashing plastic parts is available in sizes, standard and optional features, identical to that of units designed for finishing metal parts. The barrels of definners, however, are furnished fabricated of 1/16" reinforced wire mesh providing 4 open squares to the square inch. Openings this size are said to be sufficiently large to allow flash particles to fall through. Other wire mesh sizes are available for special applications.

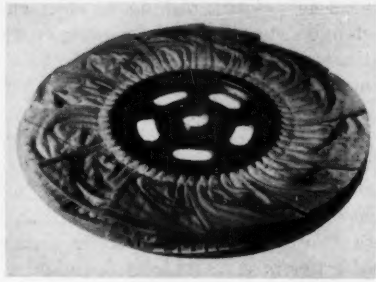
The units can be fitted with a variety of drives to meet individual needs. The overhead type of motor mounting is standard. Parallel gear head motor of the fixed speed is also available in place of the standard variable speed and drive. Horsepower ratings range from ½ on the smallest (21" x 20") unit to 1 on the largest (30" x 48") unit.

Dual-Purpose Buff

Midwest Buff Mfg. Co., Dept. MF, 2515 E. 79th St., Cleveland 4, Ohio.

The Monobuff is a new dual-purpose cut-and-color buff which combines fast-cutting characteristics of a sewed or a bias-type buff and the high-coloring properties of a loose buff. The patent-applied-for construction employs a double row of wide, overlapping blades. Overlapping blades cut aggressively yet provide soft wiping action too. The buff, which actually runs cooler than conventional air-vented buffs, it is claimed, may be rotated in either direction.

Little operator skill is needed to use the buff to full advantage. Sidewise wiping action of the overlapped blades eliminates need for canting the



work piece and provides long buff life. There are no compound streaks or buff marks on the work. The buff's free-cutting action minimizes drag, reducing operator fatigue or power drain on automatics.

As the buff wears, more plys appear and the density increases to compensate for loss of peripheral speed. The buff is available in three types: full cloth (64/68, 80/92, or 86/93), cotton pieced, and sisal with cotton covers. All fabric is biased before assembly, assuring completely biased working edges. A wide variety of sewings is employed to engineer the buff for specific applications. Different densities are provided by varying the sewing, number of plys, or number of blades. It is available treated for prolonged life and faster cutting, and in standard diameters of 14 to 20 inches; metal centers are 5, 7, or 9-in, fixed or removable.

Paint Stripper

Oakite Products, Inc., Dept. MF, 118 Rector St., New York 6, N. Y.

A new alkaline-solvent compound, designed to strip acrylic, alkyd, and other resistant paint finishes, Stripper 150 removes difficult paints in a simple soaking operation. It may be used in ordinary steel tanks, is safe on steel and magnesium, and inhibited against attack on aluminum, zinc, and brass. It has no flash point, and contains no phenolics. A wax seal on the surface of the compound retards evaporation, increases life of the stripper.

Sulfur-Free Semi-Bright Nickel

Udylite Corp., Dept. MF, Detroit 11, Mich.

An advanced process for electroplating a coating of sulfur-free, semi-bright nickel, N2E is an important advance in the plating industry because of its extreme simplicity of operation, consistent uniformity of coating appearance, ease of control and econom-

ical use of continuous filtration with activated carbon. One of the basic advantages over other semi-bright nickel processes, it is claimed, is the lack of harmful breakdown products.

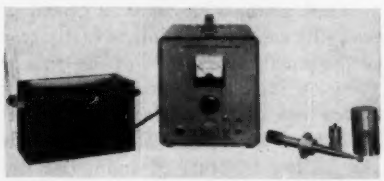
The new process involves the simultaneous addition to the electroplating bath of two addition agents, Brightener E and Brightener 2N. The former is effective chiefly in the low and intermediate current density ranges; the latter works primarily in the intermediate and high current density areas. Combined, they promote uniformity and consistency on high and low surfaces of formed metal parts. One advantageous feature enables electroplaters to pour the addition agents directly into the bath without first passing them through a filter. Because of their nature, appreciable errors in adding the agents to a bath will not result in serious trouble.

The process can be applied in any plating sequence in which other semi-bright nickel processes are now used. It readily permits the use of higher bath temperatures, up to 150°, for high-speed plating. The deposit is especially adaptable to buffing and scratch brushing operations. The semi-bright nickel coating is unusually receptive to subsequent bright nickel deposits. This combination, with a final chromium plate, has proved to be extremely satisfactory in prolonging service life in corrosive environments.

Ultrasonic Generator

International Ultrasonics, Inc., Dept. MF, 1697 Elizabeth Ave., Rahway, N. J.

The Inson 100 PW generator has connections for any of 10 output impedances, which may be selected from a broad range to match any impedance requirement. Any nominal frequency may be specified from 10 to 100 kc or greater. Power output is continuously-variable from zero to full power. Frequency range of the standard unit is 35-45 kc, and impedances are 17.5 to 20,000 ohms. Other frequencies and impedances are available on special order.



The generator may be used with piezoelectric or magnetostrictive transducers. Assistance in matching to customers' transducers and loading conditions is offered by the manufacturer, or transducers of any type can be furnished with the generator. Available transducers include an exclusive new type that can be repositioned and interchanged when desired. An ultrasonic cleaning tank is also available.

Soak Cleaner

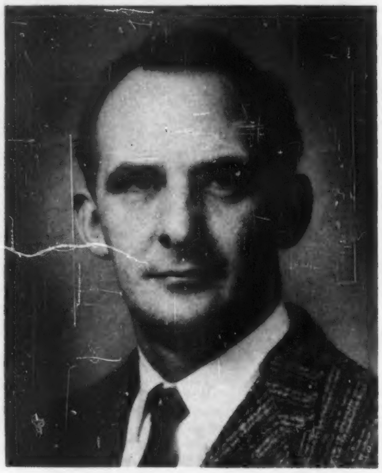
J. B. Ford Div., Wyandotte Chemicals Corp., Dept. MF, Wyandotte, Mich.

Nuvat is a new type, powerful, free-rinsing soak cleaner based on synthetic-type detergents. Designed for use in plating lines for soak or barrel cleaning, it also is recommended for soak cleaning in vitreous enameling lines, and for general soak cleaning of steel, stainless steel, copper, brass, nickel, and magnesium.

A non-dusty, non-caking product that is readily soluble, the product develops no disagreeable odors or fumes even at boiling temperatures, contains no cyanides, chromates or cresols, creates no waste disposal problems. It is said to be chemically balanced to provide exceptional life and designed to operate effectively at comparatively low concentrations, even under heavy soil loads.

Manufacturers' Literature

Kotkowski Joins Rapid Electric



Joseph F. Kotkowski

Joseph F. Kotkowski, a graduate of the University of Connecticut (BSEE), has become a member of *Rapid Electric Co.'s* engineering staff assigned to the Brookfield, Conn. plant.

Previously, he functioned as a distribution engineer for Norwich Gas & Electric Co. Previous posts were with Sikorsky Aircraft and Doman Helicopter Inc., as chief design—test engineer and operations manager of electronic and servo mechanisms for aircraft instrument simulators.

He served as a navigator-bombardier with the Eighth Air Force in Europe. Mr. Kotkowski is a member of the Institute of Radio Engineers, American Institute of Electrical Engineers and American Helicopter Society.

Glidden Appoints McElroy and Jones

Appointment of *George H. McElroy* to the newly-created position of sales manager of the Metals Department of the *Glidden Co.'s* Chemicals Division was announced recently. It was also announced that *John O. Jones* has joined the firm as Cleveland district sales manager for the Pigments and Color Department of the division, replacing Mr. McElroy. Both men will headquarter in Cleveland but will report to *Ralph B. Quelos*, general sales manager for the two departments with headquarters in Baltimore.

Precker to Head Sales For Atlee Division

Richard R. Precker has been named sales engineer for the Ashdee Electrostatic Division of the *Atlee Corporation*. In this post, Mr. Precker will be in charge of all sales for the division, which manufactures electrostatic paint spraying equipment.

Hooker Elects Stiegman and Hornbostel Vice-Presidents

Two new vice-presidents of *Hooker Chemical Corp., Dr. Chris A. Stiegman* and *Charles C. Hornbostel*, were elected at a board of directors meeting.

Dr. Stiegman is now vice-president — research and development, and Mr. Hornbostel is vice-president — finance. They had been respectively director of research and director of finance. Both officers will remain at their present locations: Dr. Stiegman at Niagara Falls, N. Y. and Mr. Hornbostel at New York headquarters.

Including service with the former Oldbury Electro-Chemical Co., now merged into Hooker, Dr. Stiegman has been with the corporation for 23 years. Soon after the merger in late 1956, he became director of product development and later technical director and, in February 1959, was named director of research.

Dr. Stiegman began his career with the former company in 1937 as technical assistant to the production manager. He earned successive promotions at Oldbury as manager of new product development, assistant secretary, secretary, manager of technical service and, in 1950, became an Oldbury board member and director of technical service, subsequently being named vice-president and technical director.

Dr. Stiegman holds B.S., M.S., and Ph.D. degrees from the University of Illinois where for four years immediately prior to joining the company he held a teaching fellowship. He is the author of several published scientific papers, and holds membership in Sigma Xi, American Chemical Society, American Association for the Advancement of Science, New York Academy of Science, American Institute of Chemical Engineers, American Institute of Chemists, Electrochemical Society, Chemical Market Research Association, and the Armed Forces Chemical Association.

Branson Names Jacke Vice-President

Stanley E. Jacke has been named vice-president in charge of engineering and research in the power division of *Branson Instruments, Inc.*, Stamford, Conn. manufacturers of ultrasonic equipment. He was formerly president of Sonic Energy Corp. (Setauket, L. I., N. Y.), an ultrasonic research firm which has been purchased and absorbed by Branson.

Prior to establishing his own firm, Mr. Jacke was manager of sales engineering for Acoustica Associates, Inc., and, before that, supervisor of ultrasonic research and development for Detrex Chemical Industries, Inc. He holds several patents for design of ultrasonic power transducers and processing equipment. For the past year, Mr. Jacke has been president of the Ultrasonic Manufacturers Association, the industry's trade group.

Stanley E. Jacke

A graduate of Purdue University with a Bachelor of Science degree in Electrical Engineering, Mr. Jacke was a member of Eta Kappa Nu and Tau Beta Pi honorary societies. He is a member of the Institute of Radio Engineers, Acoustical Society of America, and American Institute of Physics.

Van Straaten Names Vice President

Dr. George E. Barker has been named vice-president and director of research at the *Van Straaten Chemical Co.*, Chicago. He was formerly director of the metal laboratories of the Quaker Chem. Prod. Corp. and has headed group research at Atlas Powder Co. He was a senior industrial fellow at the Mellon Institute of Industrial Re-

search, a researcher at National Aniline Division of Allied Chemical and Dye Corp., and an assistant instructor at the Massachusetts Institute of Technology, where he received his Ph.D. in organic chemistry.

The new director of research is a member of the American Chemical Society and the American Society of Lubrication Engineers.

Dr. Barker also has served on several technical committees and was a member of the board of governors of the Chemical Specialties Manufacturers Association, where he also served as chairman of the division of soaps, detergents and sanitary products. He also was chairman of the sub-committee on metal cleaners of the National Security Industrial Association.

Diamond Alkali to Market Duramir Process

General Development Corp. has announced that its new Duramir chrome-plating processes will be marketed by *Diamond Alkali Co.*, one of the nation's leading chemical producers. Under an agreement approved by both companies, Diamond will take over the processes in a program which will include special training for personnel, preparation of technical data and manuals and, initially, a concentrated sales campaign in selected test areas.

The processes are three in number. One of them provides for the direct plating of chromium onto aluminum or aluminum alloys by novel and simplified techniques. The second process provides for plating of a brighter, more durable chromium onto a wide variety of basis metals after application of a bright nickel plate. The third process, which is adaptable to newly developed plating systems, produces a corrosion-resistant, crack-free, mirror-bright chromium plate on aluminum as well as the other normal basis metals. Patents are pending on these unique processes.

General Development has its own chrome-plating division, headed by *R. L. Deubner*, a former Battelle executive, to co-ordinate the business, patent and research phases of the operation.

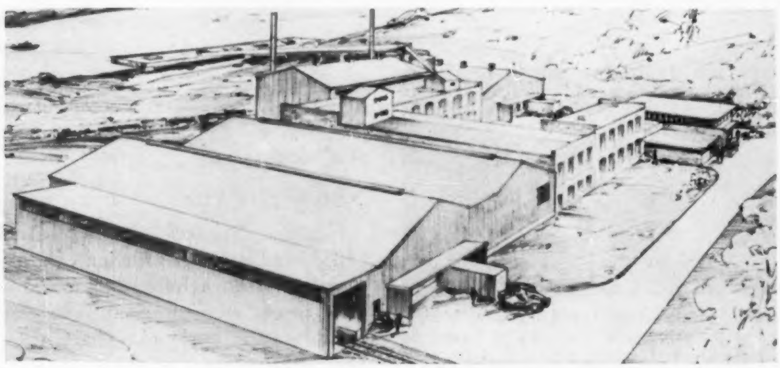
Thornton Retires from MacDermid

Cecil Thornton, sales representative for *MacDermid, Inc.* in the Rochester, N. Y. territory, has announced his retirement from the company after 36 years service. At a recent gathering, *Harold Leever*, president of the Waterbury, Conn. manufacturer of metal cleaning, plating and finishing chemicals, presented a sterling silver coffee service engraved with the names of company officers and salesmen to Mr. and Mrs. Thornton. *Fred Johnson* will take over as sales representative in the Rochester area.

Cecil Thornton (right) and his wife, Marian, being presented with silver coffee service by Harold Leever (center), president of the firm.

New Cowles Plant

Cowles Chemical Co., Cleveland, Ohio, has begun construction of a new chemical plant in Joliet, Ill., according to a recent announcement. The company's major basic chemicals, detergent silicates, and products for commercial laundries, food processors and metal finishers will be manufactured in Joliet upon completion of the plant next summer. The Promat Division of Poor & Co., Waukegan, Illinois, purchased on September 1, will be moved

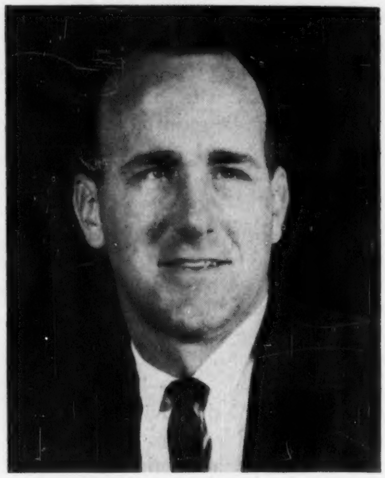


to Joliet when the plant is ready.

The new location was selected to provide more efficient and prompt service to customers in the Midwest, South and West than is now possible from existing plants in Skaneateles Falls and Lockport, N. Y. and Sewaren, N. J.

Industrial Systems Appoints Sales Engineer

Industrial Systems Co. of Matawan, N. J. announces the appointment of *Roy H. Minton* as sales engineer.



Roy H. Minton

Mr. Minton, a graduate of Hofstra College, has a background as an industrial sales engineer, active in the design, engineering and sales of furnaces, ovens, boilers, combustion units, and safety and control systems. His experience in process engineering will lend itself well to the sales and promotion of cleaning and finishing systems.

O'Brien Appoints McKesson & Robbins Exclusive Distributor

O'Brien Industries, Inc., Livingston, N. J., producers of inhibitors for hydrochloric, sulfamic and other acids, announces the appointment of *McKesson & Robbins, Inc.*, New York City, as exclusive distributor for their products in the Mid-West, Southern and Eastern parts of the United States.

This exclusive agreement will give the manufacturer complete coverage through distributors of the entire United States, allowing for stocking of their various inhibitors in all major cities with over-night delivery to customers as well as technical service provided by McKesson & Robbins.

Sax Heads Investment Firm

Ben P. Sax has been elected president of the newly-formed *Mid-North Small Business Investment Corp.*, Chicago, Ill. Mr. Sax is chairman of the board of *American Buff Co.*, Chicago, one of the world's largest manufacturers of buffs. and president of *J. J. Seifen Co.*, Detroit, Mich., manufacturer of buffing compounds.

National Bank of Chicago is participating in the new investment firm,

Ben P. Sax

one of the first of its kind in Chicago. The new corporation maintains offices at 111 North Wabash Ave., Chicago, Ill.

Pfaudler to Build Research and Development Center

The Pfaudler Co. has formally announced its plans to build a three-quarter-million-dollar research & development center in Henrietta, a suburb of Rochester, N. Y., providing a selected site is rezoned for industrial use.

The technical center will initially have approximately 40,000 square feet of floor space to which additions will be made to accommodate technical growth. The firm's present technical space totals only 25,000 square feet and is in two sections of the city.

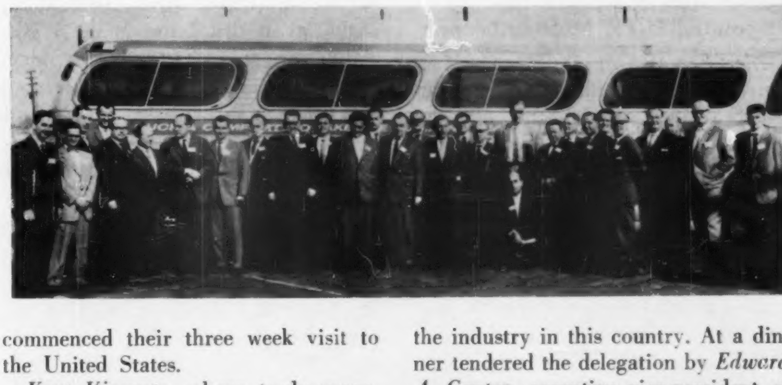
Nuodex Names Manager of Plating Chemicals Division

The appointment of *Michael Sandor* as manager of plating chemicals has been announced by *Nuodex Products Co.*

Mr. Sandor, a graduate chemical engineer of Newark College of Engineering, joins the firm with twelve years' background in the chemical marketing field. He was formerly with Nopco Chemical Co., where he headed the Metal Processing Chemicals Division. He is a member of the Wire Association and the American Powder Metallurgy Institute.

West German Paint & Lacquer Industry Leaders Tour the United States

Arriving by plane and ship in New York City, a delegation of twenty-five influential executives of the West German paint & lacquer industry have



commenced their three week visit to the United States.

Kurt Vincentz, whose trade magazine "Farbe und Lack" is sponsoring this trip, has stated that their purpose in coming is to study methods, production, equipment, and products of the industry in this country. At a dinner tendered the delegation by *Edward A. Cantor,* executive vice-president of *United Lacquer Mfg. Corp.,* process data was exchanged between technical editors representing the U. S. and the group's spokesman.

Van Waters & Rogers, Inc. Appointed H-VW-M Distributor

Alert Supply Co., subsidiary of Hanson-Van Winkle-Munning Co., has announced the appointment of *Van Waters & Rogers, Inc.*, with offices and warehouses at Seattle and Spokane, Wash.; Portland, Ore., and Boise, Idaho, as its distributor in the Washington-Oregon-Western Idaho territory.

Van Waters & Rogers, Inc., formed in 1924, has an extensive background in industrial chemical sales and scientific supplies. The company owns and

operates large warehouses in Seattle, Spokane, Portland and Boise, which guarantees fast, overnight delivery.

Vensel in Charge of Western Sales for Cincinnati Cleaning

William A. Vensel

William A. Vensel has been placed in charge of western sales of *Cincinnati Cleaning & Finishing Machinery Co.* He will conduct California sales and engineering activities for the Ohio manufacturer of industrial cleaning and finishing equipment and systems, particularly in the Los Angeles, San Diego and San Francisco areas.

A California resident since 1938, Mr. Vensel is a mechanical engineering graduate of Carnegie Institute of Technology (Pittsburgh, Pa.) with wide practical experience in metal finishing processes, equipment and related subjects. Most recently, he has been connected with the Paint Finishing System & Equipment Division of C. F. Butz Engineering, Azusa, Calif., and the Paint Finishing System department of Turnkey Engineering Co., South Gate, Calif.

Mr. Vensel is a registered professional mechanical engineer and a member of the American Electroplaters' Society and the American Society for Metals.

Mr. Vensel has established an office at 56 North Hill Ave., Pasadena, Calif. and plans a branch office in the San Francisco area.

Wilgan Joins DuBois

His East Coast friends and business associates will be interested to learn that *Walter E. Wilgan*, formerly of Kelite Corp., has been engaged as technical sales representative by *Du-*

Bois Chemicals, Inc., Cincinnati, Ohio. He will continue to specialize in the sales and service fields concerned with metal finishing and aircraft conditioning and cleaning.

Wilgan was educated at City College

William E. Wilgan

of New York, and served his apprenticeship with Permutit Co. as a technician in the field of chemical water treatment. His seven years service experience prior to his present appointment made Wilgan a well-known figure in the areas of service to overhaul and production at the larger eastern aircraft facilities.

Phillips Mfg. to Distribute "Trisec"

Phillips Manufacturing Co. has been granted a license by *Imperial Chem. Ind., Ltd.* for the manufacture of the equipment, use of the process and distribution rights of "Trisec" in the United States.

A special drying solvent, containing trichlorethylene, it is used in especially designed equipment that outwardly resembles a liquid-liquid-vapor degreasing machine, and is ideal for spot free drying after electroplating and finishing.

Columbia-Southern to Add Facilities in Texas

Columbia-Southern Chemical Corp. will soon start construction of facilities for certain chrome chemicals at Corpus Christi, Texas. This multimillion dollar plant will complement the company's present facilities for chrome chemicals at Jersey City, N. J.

Engineering design for the plant is being done by the W. P. Kidde (Southwest) Co. of Houston, Texas.

Stevens Moves to Wallingford

As part of an expansion program designed to improve its ability to serve metal finishing and foundry customers in the New England area, *Frederic B. Stevens, Inc.* has moved its plant from New Haven to Wallingford, Conn. The new installation is located at 440 S. Colony St., and enables the 78-year-old Detroit concern to greatly expand its facilities for the manufacture of buffing compositions and the warehousing of supplies and equipment for the foundry and metal finishing trades.

Walter Lynch

Situated on Highway 5, just a stone's throw from the Wilbur Cross Parkway, the new branch is ideally located for service to the entire New England area and is within quick-delivery-time of New Haven, Waterbury, Hartford, Meriden and New Britain. A well equipped laboratory for the testing of metal finishing materials and equipment is also being established in the new building.

Walter Lynch, regional manager in New Haven, will continue in this capacity at the Wallingford Branch.

Hubbard-Hall Announces Executive Appointments

Hubbard-Hall Chemical Co., Waterbury, Conn., has announced the fol-

Frederick S. Foster

lowing appointments, following a realignment of responsibility and complete reorganization of the Industrial Division.

Frederick S. Foster, vice president, will head the Heavy Chemicals Department. This department concentrates on the sale of heavy chemicals, both in bulk and in drums to industrial users throughout southern New England. Foster will also be responsible for marketing the products of the newly completed industrial chemical tank farm located in Waterbury, as well as Connecticut Chlorine Products Co., a wholly owned subsidiary, also located in Waterbury.

Theodore Z. Voyda, assistant vice president, and an expert in the field of metal finishing research and development, will manage the Metal Finishing Department. In this position, Voyda will head the department's technical, research and sales staffs.

Charles T. Kellogg, assistant treas-

Theodore Z. Voyda

Charles T. Kellogg

urer, will be manager of the Distributor Sales Department, which is geared to service distributors handling anodes and metal finishing supplies.

Ionic Appoints Great Britain Distributor

The appointment of *H. R. Noble, Ltd.*, 236 N. Circular Road, Palmers Green, N. 13, London, England, as exclusive Great Britain distributor has been announced by *Ionic Electrostatic Corp.* Noble will maintain a stock of equipment as well as demonstration facilities. For fast service, English manufacturers interested in the advantages of electrostatic coatings are urged to make direct contact with *H. R. Noble*, managing director.

Rothstein Named Regional Sales Engineer for Technic

Appointment of *William Rothstein* as regional sales engineer for *Technic, Inc.*, was announced recently. He will be in charge of sales and service of gold, platinum, rhodium, and palladium solutions to platers and other users throughout the Central United States.

William Rothstein

Formerly chief plater for Unity Mfg. Co., Chicago, Rothstein has been associated with electroplating firms in the Chicago area since 1950. He is a member of the A.E.S.

Macioce Joins Illinois Water Treatment Co.

Frank Macioce, who has been director of ion-exchange activities at Industrial Filter & Pump Co. of Chicago for the past 11 years, has joined the New York office of *Illinois Water Treatment Co.* of Rockford, Ill. He will concentrate his efforts in the metropolitan

Frank Macioce

area, supplementing the work of others now under the general direction of *Joseph Thompson,* eastern manager since 1954.

Mr. Macioce received his engineering B. S. in 1934 from the College of City of New York, and a degree in Chemical Engineering the following year from the same institution. Before going to Chicago in 1949, he was for three years employed in the ion-exchange products department of American Cyanamid Co. in New York.

Stevens to Distribute Wyandotte Products in New England

Wyandotte Chemicals Corp., J. B. Ford Division, has announced the appointment of *Frederic B. Stevens, Inc.,* as a distributor for their metal cleaning and finishing products in the New England area. Stevens already is handling the line in the midwest.

Stevens is a 76-year-old Detroit firm whose main office is located at 1800 18th St. It is widely known as a manufacturer of automatic metal finishing and processing equipment and as a distributor of supplies to the metal finishing industry. It will maintain a complete stock of metal cleaning and finishing products in its new warehouse facilities in Wallingford, Conn.

Oakite Appoints New Representatives

Oakite Products, Inc. have announced the appointment of two new technical service representatives to the company's field organization, *Robert D. Casey* and *Michael D. Juliana.*

Mr. Casey will represent the company in Arizona, with headquarters in Phoenix. Mr. Juliana has been ap-

Robert D. Casey

Michael D. Juliana

pointed to the Charleston, W. Va. territory.

The two new representatives have completed an intensive seven-week training course in the New York laboratories of the firm.

J. Holland and Sons, Inc. Forms Subsidiary

A new organization formed for the purpose of handling all used and rebuilt equipment sales, warehousing, and financing, has been announced by *J. Holland and Sons, Inc.* Called *H&S Equipment Sales Co.,* operations will be conducted as a division of the parent company at 481 Keap St., Brooklyn, N. Y.

Pollack Joins Sethco

Martin H. Pollack has joined *Sethco Mfg. Corp.,* Merrick, N. Y., manufacturers of custom filtration equipment, as sales and development engineer. In his new capacity, he will be responsible for design development and improvement as well as exploring methods for solution filtration. He will also offer technical assistance to distributors and users.

Mr. Pollack has been associated with the metal treating industry for the past twenty years in various capacities. He has held technical-executive positions with such firms as Spectranome Plating Corp., New York City, Vernon Plating Division of the De Jur-Amsco Corp., Long Island City, N. Y. and the Kearny, N. J. works of the Western Electric Co.

Founder of the Enley Products Corp., Brooklyn, N. Y., he designed the "Demon" and "Pup Reactor" water demineralizers and other ion exchange

Martin H. Pollack

equipment. Mr. Pollack holds several patents in the electroplating field, the most popular being the "Free Cyanide" Test Pencil and the "Jiffy-Loop" Surface Tension Tester.

Previous to his service in the U. S. Navy during World War II, Mr. Pollack organized the Heat Treating Consulting Service of New York City, which engineered many installations for metal treating and hardening. A graduate of the College of the City of New York, he is at present working on his master thesis in metallurgical engineering at the Polytechnic Institute of Brooklyn. He is a member of the A.E.S.

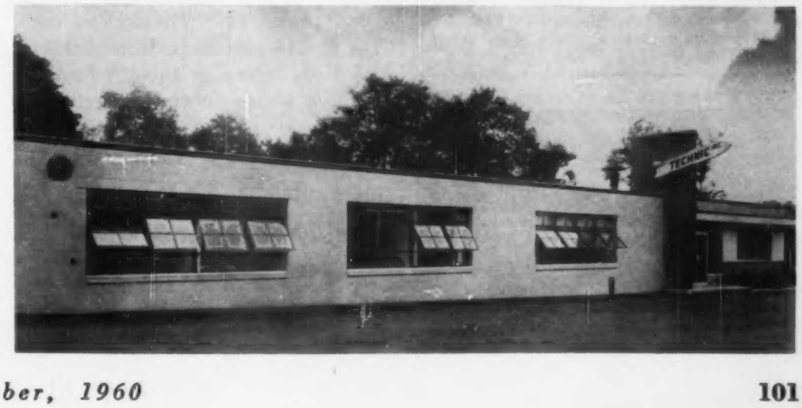
Technic Opens Plating Research Center

The Precious Metals Plating Research Center, a pilot plant which offers laboratory controls under production conditions, was opened formally at open house dedication ceremonies for the new plant of *Technic, Inc.*, Providence, R. I., recently.

The pilot plant production line consists of a series of seven-gallon tanks for all cleaning, activating, and plating procedures and solutions. The Center also includes laboratory, inspection, and testing facilities and a library of technical material on plating with precious metals.

Any companies which electroplate with precious metals have the Research Center at their disposal. The line may be operated by a company's representatives, by Technic's technical staff, or by a combination of the two. It is designed for research and development, overcoming existing problems, developing new cycles and processes, and processing samples under practical and reproduceable conditions. There will be no charge for its use.

The line, which has been under construction for a year, may be used for investigating both still and barrel plating processes. Any common metals, precious metals, and alloys may be



electrodeposited on the usual and unusual basis metals of industry.

Enthone Appoints Licensee in Mexico

Butcher-Udylite de Mexico, S. A. de C. V., (BUMSA), has been licensed by *Enthone, Inc.* of New Haven, Conn. to manufacture, sell, and service their complete line of products in Mexico. BUMSA is a subsidiary of the *L. H. Butcher Co.* of Los Angeles, Cal., also a licensee.

BUMSA manufactures plating equipment and specialty chemicals for the Mexican plating and metal finishing industry. It is headquartered at Calle Norte 45 No. 870, Industrial Vallejo, Mexico City.

Free Course in Electroplating

The course of study in electroplating given at the Fort Greene Evening High School, 29 Fort Greene Place, Brooklyn 17, New York (formerly Brooklyn Evening Technical High School) will begin its Spring term on February 1, 1961.

The session is divided into classroom discussion and laboratory experiments. The classroom topics will include simple calculation, reading graphs, chemistry of the plating tank, pH, wetting agents, pitting, deionizing. The laboratory experiments will include solution analysis, Hull cell studies, anodizing.

Registration begins January 25, 1961, and daily thereafter, from 7:00 to 8:30 P.M. Classes will meet on Mondays and Wednesdays from 6:45 to 8:15 P.M., including about 6 Fridays. The term begins February 1 and ends June 28, 1961. Register with *Mr. L. Serota* in Rooms BW17 or 3E12.

Udylite Sells Butcher Subsidiary

The *Udylite Corp.* and *Wilbur-Ellis Co.* have announced jointly that the *L. H. Butcher Co.*, a wholly-owned Udylite subsidiary has been sold to Wilbur-Ellis. The sale is subject to ratification by the respective parties' boards of directors.

Butcher started business in 1890 as a wholesaler and distributor of a complete line of industrial chemical supplies and equipment. At the present time the company, with headquarters in Los Angeles, operates in the eleven Western states. Distribution facilities are located in Los Angeles, San Francisco, Fresno, Brawley and Woodland, California; Portland and Medford, Oregon; Seattle, Washington, and Salt Lake City, Utah.

Annual sales volume is approximately $18 million with an indicated net worth of approximately $3 million. Business will be continued with no change in personnel, as a division of Wilbur-Ellis, which has for forty years been in the import and export and general trading and distributing business.

Manufacturers' Literature

Coating Thickness Tester

Twin City Testing Corp., Dept. MF, 533 S. Niagara St., Tonawanda, N. Y.

A new brochure entitled "Modern Thickness Testing" comprises an informative description of the various non-destructive methods currently employed for measuring the thicknesses of organic and non-magnetic metal coatings (including phosphate) on iron and steel. The advantages and limitations of each method are thoroughly discussed in light of thickness measuring instruments now available.

Chromate Conversion Coatings

MacDermid, Inc., Dept. MF, Waterbury, Conn.

MACro Brite chromate conversion coatings for cadmium and zinc are fully described in new technical data sheets. No. 58 covers a process for zinc plate, No. 61 a clear coating for either cadmium or zinc plate, and No. 73 a coating for cadmium.

Surfactants

Nalco Chemical Co., Dept. MF, 6216 W. 66th Pl., Chicago 38, Ill.

A broad spectrum of cationic and non-ionic surface active agents, ranging from fatty nitrogen derivatives to polyether alcohols are described in

four-page Bulletin K6. Among other chemicals discussed are fatty imidazoline diamines, fatty amidomonoamines, fatty amidodiamines, quaternary ammonium chlorides, oxyalkylation products, and colloidal silicas. Physical characteristics of the chemicals and some of their uses are included.

Chemical and Metal Finishing

Hubbard-Hall Chemical Co., Dept. MF, 28 Benedict St., Waterbury 20, Conn.

A chemical and metal finishing newsletter is designed to keep New England metal finishers aware of new products being developed at the above firm, and alert to technological changes in the metal finishing and chemical industries. The newsletter will be published bimonthly.

Electroplating Processes

Hanson-Van Winkle-Munning Co., Dept. MF, Church St., Matawan, N. J.

A new bulletin briefly describes all the above manufacturer's electroplating processes. The two-color, 24-page bulletin gives a brief description of eighteen processes which includes three new nickel processes: Levelume, Permalume, and Superlume.

New Chem Rite conversion coating processes for aluminum and for zinc are also briefly described, as are Cadalume, Copper-Lume, Nickel Sulfamate, Silver-Lume, and Zincalume.

An illustrated description of the H-VW-M laboratory, and testing and field services available to customers is included.

Educational Safety Films

Public Relations Dept., Dow Chemical Co., Dept. MF, 690 Building, Midland, Mich.

Four new educational safety films, each dealing with the proper handling of a common industrial chemical, are now available. The film titles are: "Handling Caustic Soda Safely," "Handling Chlorine Safely," "Handling Chlorinated Solvents Safely," and "Handling Muriatic Acid Safely." Each is a 35mm. four-color sound slide film running approximately 12 minutes.

The films are designed for use in the training of employees who work in industries which utilize the chemicals in their operations. Each film explains the nature of the chemical involved, points out the hazards of the material, and then gives a step-by-step procedure on the proper methods and techniques that should be followed when working with the chemical.

The films are available free-of-charge on a "loan out" basis.

Temperature Control

Burling Instrument Co., Dept. MF, 16 River Road, Chatham, N. J.

Bulletin 109 gives a full description of the Model LD-1S indicating differential expansion type temperature control.

Selective Plating

Selectrons, Ltd., Dept. MF, 520 Fifth Ave., New York 36, N. Y.

An eight-page booklet lists varied engineering applications of a new, high-speed selective plating process. In addition to discussing problems solved by the new method, the brochure lists available equipment, techniques, and results achieved. It also has a one-page question-and-answer section for a quick overall idea of process capabilities.

Conversion Coating

Rust Proofing and Metal Finishing Corp., Dept. MF, 75 Commercial Ave., Cambridge 42, Mass.

A four-page, illustrated brochure is available on Endurion, a chemical immersion treatment for iron and steel. The booklet answers such questions as what the product can do, how it is

applied, the cost, what equipment is required, etc.

Exhaust Systems

Indust Plastics Div., Industrial Sheet Metal Works, Dept. MF, 4025 Bergen Turnpike, No. Bergen, N. J.

Illustrated bulletin A-1 gives information on the use of corrosion resistant reinforced plastics for ventilating hoods, ducts, stacks, tanks, etc. in fume exhaust systems.

Descaling with Citric Acid

Chas. Pfizer & Co., Inc., Dept. MF, 630 Flushing Ave., Brooklyn 6, N. Y.

Data Sheet No. 557 describes chemical cleaning with citric acid solutions. Included are the advantages for iron oxide removal and analytical methods for control of the baths.

Centrifugal Pumps

Aurora Pump Div., New York Air Brake Co., Dept. MF, Aurora, Ill.

A new bulletin illustrates and describes a line of vertical single-stage split case centrifugal pumps for applications where extreme compactness is of prime importance, handling high capacities at medium to high heads and continuous operation.

Paint Finishing Systems

J. O. Ross Engineering Div., Midland-Ross Corp., Dept. MF, New York 17, N. Y.

A 12-page bulletin describes complete paint finishing systems, and component units. The bulletin, PF-400, includes a pictorial story of the finishing line, pictures, descriptions and technical data of the individual component parts, construction and conveyors.

Also, there is a section on a strip coating line, metal decorating units, and the firm's laboratory facilities.

Finishing Equipment and Supplies

J. Holland & Sons, Inc., Dept. MF, 478 Keap St., Brooklyn 11, N. Y.

This 146-page illustrated catalog is bound in a sturdy simulated leather cover and includes literature on machinery and supplies, including drying ovens, tumbling barrels, rectifiers, control panels, all variety of steel and wood tanks, polishing jacks, etc.

All items listed are carried in stock and available for immediate shipment.

Finishes for Magnesium

Dow Metal Products Co., Dept. MF, Midland, Mich.

A reprint, "How to Specify Finishes for Magnesium," discusses the availability and relative merits of chemical treatments and paints for use on magnesium.

Representative costs and typical finishing systems for interior and exterior use are given.

Polishing Speed Calculator

Hanson-Van Winkle-Munning Co., Dept. MF, Church St., Matawan, N. J.

A handy 3 x 5 inch disc calculator for determining the surface speed of both buffing and polishing wheels, printed in two colors, gives easy-to-use instructions on how to find the surface speed, in feet per minute, of any wheel from 1" to 60" in diameter, turning at spindle speeds from 220 to 20,000 r.p.m.

NEWS FROM CALIFORNIA

A group of plating shop operators in the San Fernando Valley area of Los Angeles is sponsoring a movement to persuade the State of California to establish a platers' apprenticeship council, through which young men desirous of entering the plating business could obtain on-the-job training in shops combined with classroom instruction.

In mid-October a committee of shop owners, headed by *C. E. DeLucca*, owner of Space-Age Plating Co., Van Nuys, was assembling information and mapping plans which were to be presented to the California State Board of Education upon completion, probably some time around the first of the year.

It is expected to pattern the council after other industry councils which now direct apprenticeship training programs in a score or more industries, such as plumbing, heating and ventilating, refrigeration, plastering, carpentering, and others.

A three-year course of apprenticeship training would be involved for embryo platers. That would include specified periods spent in classrooms and concluding periods in Southern California plating shops for practical on-the-job training under experienced metal finishers.

Active in the promotion of the plan are the following San Fernando Valley plating shop owners. DeLucca, chairman; *Donald Hudson*, Hudson Plating Co.; *Ted Goodman*, Michael-Rand Plating Co.; *Roland Moody*, Chemical Metals Co.; *Henry Sakland*, Vineland Plating Co.; *Edward Brookshire*, Dialectric Plating Co.; and *Don Dixon*, Dixon Hard Chrome Co. *Meyer Roter*, formerly a shop owner in the valley, serves the committee in an advisory capacity.

If the proposal is instrumentated by the state, it is hoped the classes will be held at the Van Nuys Adult School in Van Nuys. While this school is more readily accessible to student platers in the San Fernando Valley, apprentices from other areas of Los Angeles and Southern California would be eligible for admission if they pass the entrance requirements.

B. F. Goodrich Chemical Co. recently moved into a new vinyl resin manufacturing plant at 2104 E. 222nd St., Long Beach, Calif. It is the firm's first such plant west of the Mississippi River.

The new plant is equipped to produce Geon resins and special compounds used by fabricators in many industries, including insulation coatings and corrosion protective coatings for metals.

Turnkey Engineering Co., Inc., South Gate, Calif., recently was acquired by Electric Furnace Co. of Salem, O., and now is being operated as a subsidiary of that firm. Turnkey was established in 1951 and has op-

erated as a designer, builder and installer of plating systems, metal cleaning equipment, spray booths, baking ovens, heat treating equipment and industrial conveyor systems.

Under the new corporate setup, *Kenneth U. Wirtz*, president, and *R. E. Coe*, vice-president, of Electric Furnace Co., serve as chairman of the board and assistant secretary-treasurer, respectively of Turnkey. *Jess J. Andresen* continues as president of Turnkey and *James G. Shaw* and *E. J. Ryan* as vice-president and secretary-treasurer.

H. C. McClellan, president, Old Colony Paint & Chemical Co. of Los Angeles, is one of four Southern California business leaders who have been appointed to an advisory board that will plan the 13th triennial International Management Congress to be held in New York in 1963.

Others appointed by *David Rockefeller* of New York as advisory board members are: *Charles B. Thornton*, board chairman, Litton Industries, Inc., Beverly Hills; *J. L. Atwood*, president, North American Aviation, Los Angeles; and *Charles C. Ducommun*, president, Ducommun Metals & Supply Co., Los Angeles.

The second of a three-part training program conducted by *Milton Weiner*, Southern California chemist and plating consultant, will be held at the Weiner Laboratories in Santa Fe Springs, Calif., for 12 weeks beginning January 9.

The course will be devoted to chemistry and electrochemistry and their applications to plating, and is a follow-up to Program A on electroplating and metal finishing which was held in September, October and November. The third part of the course on electroplating cost and calculations, will be offered once a week for 12 weeks beginning March 28.

Jack H. Zillman has been elected vice-president of the data processing divisions of Consolidated Electrodynamics Corp., Pasadena, Calif. Serving under executive vice-president *Robert H. Garretson*, Zillman is in charge of operations of Consolidated's datalab, transducer and electro mechanical instrument divisions.

Associations and Societies

AMERICAN ELECTROPLATERS' SOCIETY

St. Joseph Valley Branch

Fifty-two members and guests attended the first meeting of the 1960-61 season, on Oct. 5. President *Walter Manson* called for a round robin of introductions after which the election of new officers was held. The new officers were:

President — *Theodore D. Shafer*.

First Vice-President — *Jack Petersen*.

Second Vice-President — *Louis Rague*.

Secretary — *Henry Meers*.

Treasurer — *George Shuman*.

Librarian — *John Devendorf*.

Board of Managers: *Joseph Curtis, Richard Aiken, Victor Peterson*.

Delegates for the 1961 Convention: *Theodore Shafer, Ralph Wysong, Gene Roth*.

Alternate Delegates: *Elmer Brady, Jack Petersen, Dr. Harold Wiesner*.

"Duke" Wysong — past national president, installed the new officers and spoke briefly on the responsibility of these officers to the branch members and the importance of their duties. The meeting was then turned over to the new president, Mr. Shafer, who thanked the membership for the honor. He then called on Mr. Wysong to report on the Los Angeles Convention. Mr. Shuman gave a financial report and urged that a motion be made that the branch dues be completely paid up by the May meeting. This motion was quickly passed. Dr. Wiesner gave a brief outline of a proposed basic and advanced plating course and those responsible for their presentation. The course will begin in March to avoid inclement weather and holiday conflicts.

The meeting was then turned over to the new librarian, *John Devendorf*, who introduced the speaker of the evening. *Charles H. Stade*, liaison engineer, Kanigen Division, General American Transportation Co., who explained the many and various applications of electroless nickel.

Slides were shown to illustrate some of the many problems encountered. They were followed by a brisk and interesting question and answer period after which Mr. Stade was given a standing round of applause for a very well prepared and delivered paper.

The meeting was adjourned at 10:30.

Henry A. Meers,
Secretary

Rochester Branch

In the absence of prexy Cipolla, the second regular meeting, on October 3rd, was called to order by 1st V.-P. *Chas. Fedeor*. Three guests were introduced, *Wade Odum*, *"Gil" DeGraver* and *C. E. Miller*.

Cecil Thornton, for his dedicated help to the branch, was unanimously elected as Honorary Member.

Christmas party chairman Pottridge reported that tickets were available for

our annual get-together, this time at Midvale Country Club.

Mr. Fedeor requested members to promote the branch to prospective members. A letter of a similar nature will be sent to local manufacturing plants. Second V.-P. Elston will send letters to individuals interested in the science of metal finishing.

There was no further new business so Librarian *Loring Carson* introduced *W. A. Helbig* of the Darco Div. of Atlas Powder Co., who spoke on activated carbon.

E. A. Pottridge,
Acting Secretary

Los Angeles Branch

Walter Behlendorf, chairman of the convention financial committee, presented *Frank Virgil*, president of the Branch, with a thousand dollar check at the Oct. 12 meeting, as the local branch's share of the profits from the 1960 A.E.S. convention in Los Angeles in July.

Behlendorf gave a report on the financial aspects of the convention which he said was final and official except that the audit would not be completed for several days. He announced that registrations totaled 1,077 including 740 members and 337 ladies. The chairmen and members of the various committees were introduced by General Chairman *Tony Stabile* and were given a vote of thanks by the membership.

The branch elected delegates to the 1961 convention in Boston at the Oct. 12 meeting. Delegates chosen were *Francis T. Eddy, Tony Stabile* and *George Hetz*. The alternates are: *Norman Painter, Emmett H. Babcock* and *Earl Arnold*.

Officers and members of the board of managers met prior to the general meeting and set the date for the 1961 educational session as April 8, with the Statler Hotel as headquarters. *William Thomas* was named general chairman.

Don E. Baudrand, chairman of the Handbook Committee, reported that a copy of the handbook completed under Branch sponsorship this summer has been mailed to each member. He declared that the handbook has been given a gratifying reception by the membership as well as by outside interests. It has been reviewed by the Educational Board of the Supreme Society as well as by the editors of various industry and other publications. Requests for copies, according to Baudrand, have been received from libraries in many sections of the United States and other countries. This is the second Handbook issued under the sponsorship of the Branch. Some 12 or so years ago, the late *Ernest Lamoreaux* served as editor of a handbook of approximately half the size of the 1960 issue.

An educational program devoted to "Printed Circuits" drew an attendance of 90 members and guests to the meeting. In a recent survey conducted by the educational committee to determine members' preferences in speakers' subjects, printed circuitry stood high on the list. Handling the subject were two members of the branch whose experience and background made them well qualified to discuss printed circuits from both practical and technical points of view. They were *Claude C. Weekly*, western division manager for MacDermid Pacific, Inc.; and *Emmett Babcock*, supervisor of production control at Convair, Inc., in Pomona, Calif.

Newark Branch

Pres. *John Banta* called the Oct. 21 meeting to order at 8:30 P.M. About 50 members and guests were in attendance, including *Bill Quinn* from Danbury and *Jim Quarl* from Bridgeport.

Three applications for membership were received, and six applicants were elected to membership. They were, *Martin Klein*, L. R. Metal Treating Corp.; *Fred Kelly*, Servometer Corp.; *F. E. Allen*, S. S. White Dental Mfg. Co.; *Anthony W. Bugna*, H. C. Schick Co.; *Robert H. Messing*, Sel-Rex Corp.; and *Henri Boillat*, Parochimie, S. A.

Three transfers into the Branch also were received. They were *Gordon Lyons*, H-VW-M Co., from Dayton; *A. Nortog*, H-VW-M Co., from Cleveland; and *Richard Brenneman*, Sel-Rex Corp., from Baltimore - Washington. *Don Foulke* announced that *Peter Arnold* was in an accident and hospitalized, and that *Jim Myron* was promoted to plant superintendent at Monroe Calculating Co.

Cy La Manna then presented *John Heineman* from Oakite Co. whose timely topic was "Conversion Coatings." He briefly covered conversion coatings for all metals, in general, and specifically for coatings on aluminum. *R. Scott Modjeska* then spoke on "Printed Circuits and Electroplating." Mr. Modjeska covered well the various pros and cons of plating printed circuitry.

Gustav Bittrich,
Assistant Secretary

St. Louis Branch

The regular monthly meeting was held Oct. 12 at the York Hotel, with 24 members and guests present for dinner. There were 30 members and guests present when President *George Koderhandt* called the meeting to order.

Three new members were accepted.

Communications consisted of a notice of the Midwest Regional meeting to be held at Notre Dame, a letter from Headquarters pertaining to membership expansion, sustaining membership report, letters concerning scientific achievement award and Honorary Membership.

A motion by *Gerard Clooney* that the new stationery have the sustaining members names shown was passed unanimously. *Andy Julius* reported that the 1960 Convention in Los Angeles was well attended and St. Louis had a good showing of members there. *Ed Sertl* reported the fall term of the Electroplating School has started; after a poor response to the mailed applications there were 25 students registered the first night. *Lou Berra* reported the banquet made $225 profit. The acoustics of the room were bad and we are going back to the Chase Hotel next year.

President Koderhandt appointed *Craig McAlister* as welfare committee chairman, *Frank Menniges* as banquet committee chairman. Mr. McAlister reported he received a letter from *Joe Andres* requesting him to contact members of the branch to see if there were any papers that would be presented at the 1962 Milwaukee Convention. If there are they should be sent to Craig so they could be approved by the educational committee.

A discussion was held relative to the meeting place, the attendance, whether we should consider changing, or if the membership would express opinions. *Ken Robins*, librarian, will attempt to get a few opinions by enclosing questionnaires in the next mailing. This concluded the business meeting and the meeting was turned over to Mr. Robins, who outlined the tentative program for this year. *Dr. Richard Saltenstall* of Udylite Corp. will talk in November on agitation in plating solutions. *Dave Nelson* of Monsanto Chemical Co. will talk in December on developments in bright dipping aluminum. The January meeting will probably be a talk on ultrasonic cleaning, pickling etc. There will be a plant trip and a talk on waste disposal.

Ken then introduced *John Nichols*, executive secretary of the A.E.S., who came here from headquarters in Newark to talk to the members. It was pointed out it was the first time since Oct. 1955 when *Clyde Kelly* was president that the branch had been honored by a visit from a national officer. John talked about the organization, the awards, the research projects and the convention. The meeting was very interesting and he received a rising ovation for his enlightening talk. The meeting was adjourned at 10:10.

Ward Kelly,
Secretary

Dayton Branch

Forty members and guests met on Wednesday evening, October 19, at the Yum-Yum Inn for a dinner meeting. During the business session, guests *Al Lipton*, *Paul Miller* and *Robert Van Fleet* were introduced, as were Cincinnati Branch members, *Bill Young*, *Dick Evans*, and *Bob Wiedemann*.

Walter Moline, *Richard Wright*, and *Richard Weaver* were elected delegates and *Robert Fisher*, *Lawrence Hadlock*, and *Byron Bowman* were elected as alternates. The application of *Ted A. Koenig*, of Ohio Electro Polishing Company, Venedocia, Ohio, was favor-

ably received.

It was announced that an evening course in plating will begin shortly after the first of the year. *Larry Hadlock* announced that arrangements had been made for a dinner meeting for members and their wives on December 14, as the annual Christmas party. This will be held at Annarino's Supper Club and will feature a speaker who will tell how to raise checks. *Bob Fischer* announced a membership drive and stated that any member bringing in three applications will receive one ticket for the 15th Annual Educational Session and dinner dance. Any member bringing in five applications will receive two tickets as an award.

The attention of the Branch members was directed to the 7th Annual Tri-State Meeting to be held in Columbus on February 4. *Bill Safranek*, educational chairman, has announced an educational program which will include:

Wm. Geissman, National Lock Co., "Buffing Zinc Alloy Die Casting" and "First Phase Project 18."

Manuel Ben, General Motors Corp. "Plating On Aluminum."

Walter L. Pinner, McGean Chemical Co. "Developments In Accelerated Corrosion Testing."

Frank L. LaQue, International Nickel Co. "Materials In Outer Space."

Richard J. Anderson, Battelle Memorial Institute. "Journey Into Ignorance."

The featured speaker of the evening was *Simon P. Gary*, vice-president of Scientific Control Labs., Inc., Chicago, Ill. His topic was "Plating on Non-Metallics."

Refreshments following the meeting were furnished through the courtesy of Hanson-Van Winkle-Munning Co.

L. A. Critchfield,
Publicity Chairman

Rockford Branch

The Branch held its first regular meeting of the season at the Woodward Governor Co. main auditorium on October 10th. President *Harold Ellis*, in a short business meeting, stressed the importance of early reservations for the 2nd annual Midwest Regional Conference. Librarian *Bob Campbell* outlined the plans and program for the annual Ladies' Night to be held November 14 at the Holiday Inn in Rockford.

Delegates and alternates to the National and Regional societies were elected as follows: Delegates, *Harold Ellis*, Commercial Wire Products Co., *Wm. (Bill) Geissman*, National Lock Co., and *Murry Hounds*, National Lock Co. Alternates: *Alexander Alexander*, Promat Div., Cowles Chem. Co., *Dick Legge*, American Cabinet Hardware Co., *Leonard Wegg*, National Lock Co.

M. C. Eley, gas turbine controls development engineer with Woodward Governor Co. talked on the "Jet Age," outlining the history of jet flight, its special fuel requirements, the methods of controlling jet fuels and showed some fuel controls. Excerpts from a $100,000 training film on jet fuel control and maintenance were shown prior to a guided plant tour.

Alexander Alexander,
Publicity

Buffalo Branch

The Branch held its second meeting of the new season on Friday, October 7, at the Peacock Inn, Mayville, N. Y.

with 42 members and guests in attendance.

President *Harold Shapiro* introduced the guests of the evening:

Miss Finger. Mr. Victor and Mr. Hilhorst from the Vanderhorst Corp.

Mr. Felton from Chautauqua Hardware.

Mr. L. Baxter and Mr. J. Henderson from Chautauqua Plating.

Mr. Shell from Buffalo Forge.

Mr. McHattie from H. K. Porter Corp. and Mr. R. Spencer.

John Donaldson reported on the status of the membership campaign and has one new member application in process. *Chuck Fotheringham*, chairman of the Christmas Committee, reported the Annual Christmas Party will be held the evening of December 3, and will feature a cocktail hour, standing rib roast beef dinner, door prizes, entertainment and dancing. Tickets may be purchased at the door for $5.50 per person, guests welcome.

It was reported by *Bert Kirchoff* and *Joe Ruff*, chairmen of the Sick Committee, that Messrs. *Robert Potter* and *Ray Blechinger* have been quite ill and are recuperating at home. A letter of appreciation was received from Bob thanking the branch members for their thoughtfulness in sending a basket of fruit to him.

A further discussion was held on the outcome of the recent Los Angeles Convention regarding the 1966 Convention being awarded to Atlanta. *Rolland Campbell* stated Buffalo followed the procedures set forth in a recent *Plating* magazine publication as to the formal procedure pertaining to obtaining a national convention.

John Tiebor introduced the speaker of the evening, *W. A. Helbig, Sr.*, of the Atlas Powder Co., who presented an interesting and educational talk on "Activated Carbon Purification of Plating Solutions." This was followed by an informative question and answer period.

Robert C. Eich,
Secretary

Phoenix Branch

Floyd Huhn, president, opened the Oct. 11 business meeting at the Interlude Club. Three guests were welcomed, *Tom Dowling*, Barrett-Haentjens; *Robert Casey*, Oakite; and *Leonard Marks*, Chem. Research. Two branch delegates were named, *Ron Dezember*, Braun Chemical; and *Bob Hays*, Motorola.

Announcement was made of the coming Christmas party which will be held December 9 at the Pulaski Club, 4331 East McDowell Road. *James Weaver* was appointed chairman of the Entertainment Committee for this event.

George Reich was elected to the board of managers to fill the unexpired term of *Dr. C. Crowley*.

After the business meeting *Bob Hays*, branch librarian, introduced *Dr. Frederick Lowenheim* of Metal and Thermit, who gave a very interesting talk on the subject of "Tin Alloy Plating"; covering especially the tin-copper, tin-zinc, and tin-nickel systems. The talk was followed by a question and answer period. The meeting was adjourned at 9:30.

Paul M. Wible,
Secretary

Blue Ridge Branch

On October 7 the members of the Branch were guests of the C. M. Hall Lamp Co. in Clinton, N. C. Twenty-seven members and guests traveled to the Eastern part of North Carolina to attend this meeting. The host company provided an evening dinner and, afterwards, a tour of their plant.

On the plant tour those attending had the opportunity to see the complete operation of this plant which manufactures automobile tail-lamp assemblies. There were several operations of interest to the group. These included die casting, burnishing, painting, buffing, automatic plating of copper, nickel and chrome, and final assembly of the parts.

The Branch elected four new members at this meeting. They are: *Don M. Oldryod*, *Ben Deal*, *Damon Antel* and *H. Fredrick Lange*.

Donald H. McGee,
Secretary

Southeastern Branch

The Branch, with its yen to do something different and be the first about it, met in Gainesville, Ga. for its October 14 meeting, and visited the world's largest buffing cloth mill, the Pacolet Plant #6 of Deering, Milliken & Co., Inc. The hosts for the occasion included *E. R. Loomer, Jr.*, of New York, and *Winston F. Garth* who is the local mill manager. Arrangements were

coordinated through *George W. Taylor*, branch program chairman, and *H. R. Stogner, Sr.*, secretary.

The program began at 2:00 P.M. with the showing of a movie on fabric manufacture. At 2:30 guided plant tours were conducted.

Following the last plant tour at 5:30, the company personnel gave a formal summation and called upon the platers to work closer with them in their search for continued improved cloth for continued improved buffing.

Visitors then met at 6:30 at the Main Ball Room of the Dixie Hunt Hotel, for a short cocktail party and then a buffet dinner, all sponsored by Deering, Milliken. After a brief business meeting presided over by *Bruce Taylor*, a question-answer session followed, conducted by Mr. Garth.

Robert H. Probert,
Assistant Secretary

Waterbury Branch

The Branch held its regular monthly meeting at the Roger Smith Elton Hotel on Thursday, Oct. 13. President *Bill Giesker* called the meeting to order and reported on the first organizational meeting of the A.E.S. branches which join together to sponsor the New England Regional Meeting. The Waterbury Branch has charge of advertising for this year's program.

The Branch acted on the following applications for membership; *Edward S. Duncan*, *Peter R. Russo* and *Evan Quarton*. Their applications were approved.

Technical Chairman *Frank Tirendi* introduced the speaker of the evening, *Laurence Durney*, of Enthone, Inc., who spoke on "Costs of Metal Finishing." Mr. Durney discussed the several methods of arriving at the cost of producing parts and the advantages and disadvantages of each. The paper was very well received and many questions followed.

Francis A. Schneiders,
Publicity

Chicago Branch

The October 11 meeting was held at Petricca's Restaurant, 510 North Western Ave. Two applications for membership were received and three new members were elected to the Branch. *Dick Connors* and *Rudy Hazucha*, of the membership committee, suggested that letters be sent to the job shops in the Chicago area to solicit new members. Members were also urged to solicit and bring a new member for the next meeting in November. *Paul Glab* urged all members to attend the Second Annual Midwest Regional Conference on metal finishing at South Bend, Indiana, on Saturday, October 29, 1960. *Joe Andrus*, chairman of the educational program for the Milwaukee Convention in 1962, asked the members as to what type of papers should be presented for the program.

Clarence Kolzow, of Western Electric, introduced the speaker of the evening, *August Mendizza*, of the Bell Telephone Laboratories. His subject was "Corrosion Problems in the Bell System." Mr. Mendizza illustrated his talk with slides and, after a lively question and answer period, was given a rising vote of thanks for his very interesting talk on corrosion problems.

Art Bartman, of Bell and Howell, will conduct a symposium on "Organic Finishing" in November.

Christopher Marzano,
Publicity Chairman

Newark Branch

At the recent Metropolitan Regional Meeting between the Newark and New York Branches, the Newark Branch awarded *Mario J. Di Chiara*, chief chemist at Royal Plating Co., Newark, N. J., the Louis Donroe Memorial Award for the best "Timely Topic" during the 1959-1960 year.

Mr. Di Chiara's talk before the Branch covered the practical aspects of color anodizing, describing the problems encountered and their correction.

Mr. Di Chiara (left) receiving the plaque from John H. Banta, president of the Branch.

Detroit Branch

The Branch had its monthly meeting on Nov. 4 at the Michigan Room, at the Statler-Hilton Hotel. This was a meeting devoted to the subject, "Plating on Aluminum." *Ralph Williams* was the technical chairman.

The speakers were: *Dr. G. H. Kissin*, Kaiser Aluminum and Chemical Corp.; *K. H. Wagner*, Aluminum Co. of America; *E. F. Barkman*, Reynolds Metals.

W. G. Anderson

New York Branch

The Oct. 14 meeting was called to order by President *Joseph Rembecki*, with all officers present. Applications for membership from Messrs. *Ludwick Gutnaier* and *Wallace G. Spiegler* were forwarded to the board of managers for further study.

Jack Weiner, chairman of the banquet committee, reports progress is being made. *Milton Nadel* informed members to report any change in address or business connection within two weeks so as to have it published correctly and promptly. He also stated that there are still thirty delinquent members after four notices were sent. If not in good standing by next week these members are to be dropped.

The following were unanimously elected as delegates and alternates to the Boston A.E.S. Convention:

Delegates: *Joseph Rembecki*, *Milton Nadel*, and *Angelo Amatore*.

Alternates: *George Herrmann*, *Isidore Friedman*, and *Arthur Carlson*.

Mr. Amatore is to head the committee for *Dave Clarin* night to be held November 11.

All further business was dispensed with and librarian *Martin Pollack* took over for "Good & Welfare." Martin introduced *Robert Dvorin*, who spoke on "Pollution Abatement."

The speaker received a rousing vote of thanks after which the meeting was adjourned.

Fred Saras,
Recording Secretary

Syracuse Branch

Roger F. Gallien of Behr-Manning Co., Troy, N. Y., addressed the Branch at the October 17 meeting. Two very interesting movies were shown on manual and automatic polishing of various metals and products by means of using abrasive belts. Mr. Gallien had an intensive listening and viewing audience who appreciated not only the excellent color movie with explanations, but also the very lively discussion which was conducted after presentation of the movie.

It was unfortunate that *Dan Gray* of Oneida, Ltd. was absent due to illness so that the branch president was unable to officially install Mr. Gray as an Honorary Member of the Branch, which had been decided upon by a unanimous vote at the membership meeting of September 19.

R. Sonnenfeldt,
Recording Secretary

San Francisco Branch

The October 13 meeting began at 7:00 P.M. with dinner at the International Inn, South San Francisco.

Through the kind auspices of United Air Lines there was a complete tour through their plating, cleaning, assembly, and jet engine overhaul plants. The tour was headed by *William Hecht*, the firm's public service relations official. There were 41 members present and 16 guests.

The tour lasted over an hour and a half and was quite complete. Members had a unique opportunity to inspect every single component part going into both the reciprocating and jet engines used by United. Actual parts being plated were inspected by the members.

Due to the lengthy time involved in the tour, usual monthly business meeting was waived and members adjourned immediately following the tour.

C. E. Snelgrove,
Secretary - Treasurer

Columbus Branch

The Branch will host a regional meeting and technical conference on Feb. 4, at the Deshler Hilton Hotel. Members of branches from Cincinnati,

Dayton, Indianapolis, Louisville and Columbus will attend.

The meeting will begin with 10 A.M. and 2 P.M. educational sessions, and will include presentation of five papers by experts from various companies.

Subjects to be discussed:

"Buffing of Zinc Alloy Die Castings," "First Phase of Project 18," *William Geissman*, National Lock Co.

"Plating on Aluminum," *Manuel Ben*, General Motors Corp.

"Developments in Accelerated Corrosion Testing" *Walter L. Pinner*, McGean Chemical Co.

"Materials in Outer Space," *F. L. LaQue*, International Nickel Co.

"Journey into Ignorance," *Richard J. Anderson*, Battelle Memorial Institute.

The meeting will conclude with a cocktail party, banquet, floor show and dancing in the evening.

Members of all technical societies are welcome, and tickets may be secured from *P. James Grote*, 3513 Roswell Drive, Columbus 13, Ohio.

Dallas-Fort Worth Branch

The Branch met Oct. 19, at Howard Johnson's Turnpike Restaurant, with 40 members and guests present. After a social hour and fine dinner, the meeting was opened by President *William Aves*. A motion was made that the Branch endeavor to obtain the 1967 National Convention for this area. The Committee for Project #20 reported that *Dr. R. L. Hoyle* from Arlington State College, midway between Dallas and Fort Worth, had been selected to conduct this investigation.

Myron Browning then introduced *J. P. Nichols*, executive secretary of the national office, who was making his first visit to this Branch. He outlined the structure of the A.E.S. and the duties of the branches.

President Aves then introduced *E. R. Rinehart*, who discussed the new plating and heat treating facilities recently installed at Chance Vought Aircraft. Both speakers were enthusiastically received by the members and guests.

Jack D. Haler,
Recording Secretary

British Columbia Branch

The first meeting of the 1960/61 season was held on Sept. 30 at the Lougheed Hotel in Burnaby, with 29 members and guests present. Following the introductions, Program Director *W. Marquardt* gave a brief report on the speakers for the coming season. A very interesting address was given by *Nelson Shepherd* on the A.E.S. Convention. He also spoke on the conducted tours, particularly chemical milling.

G. Schlossareck,
Secretary

M.M.F.A. of New England

Master Metal Finishers Assn. of New England elected new officers for 1960-61. Napoleon A. Vigeant, M&V Plating Co., Newburyport, Mass. (seated, 2nd from right) was elected president of the N.A.M.F. affiliate in the upper New England area. The election took place at the University Club in Boston's Back Bay recently.

Others elected: vice-president, William F. Acks, American Anodizing Corp., Quincy, Mass.; treasurer, Laurence Tosi, Jr., Cambridge Plating Co., Cambridge, Mass. Directors: Harry Saltzberg, Modern Electroplating Co., Roxbury, Mass.; Leo Rosenberg, Reliable Silver Plating, Sommerville, Mass.; Stuart Lowell, Lowell Silver Plating & Mfg. Co., Needham Heights, Mass.; Jack Wright, F. M. Callahan & Son, Malden, Mass.; and Fred Davino,

Left to right, seated: Tosi, Acks, Vigeant, and Swift; standing, Rosenberg, Davino, Lowell, Wright, and Saltzberg.

CALENDAR

Dec. 17: Annual Banquet and Christmas Party, Newark Branch, A.E.S., Robert Treat Hotel, Newark, N. J.

Jan. 24-27: 17th Annual Technical Conference, Society of Plastics Engineers, Shoreham Hotel, Washington, D. C.

Feb. 3-4: 3rd Annual Dixie Regional Technical Session, A.E.S., Blue Ridge Host Branch, Hotel Roanoke, Roanoke, Va.

Feb. 4: Annual Educational Session and Banquet, New York Branch A.E.S., Statler-Hilton Hotel, New York, N. Y.

Feb. 4: 7th Annual Tri-State Regional Meeting, A.E.S., Deshler-Hilton Hotel, Columbus, Ohio.

Feb. 11: 8th Interim Meeting, Supreme Society, A.E.S., New England Regional Council, Host, Statler Hotel, Hartford, Conn.

Feb. 18: 1st Educational Session and Dinner Dance, San Francisco Branch, A.E.S., Jack Tarr Hotel, San Francisco, Calif.

Mar. 1-2: Technical Conference, Society of Vacuum Coaters, Conrad Hilton Hotel, Chicago, Ill.

Mar. 20-24: 12th Western Metal Congress and Exposition, American Society for Metals, Pan-Pacific Auditorium, Los Angeles, Calif.

Apr. 22: 22nd Annual New England Regional Meeting, A.E.S., Hotel Statler, Hartford, Conn.

June 18-23: 48th Annual Convention, A.E.S., Boston Host Branch, Boston, Mass.

Plating for Electronics, Inc., Waltham.

Executive secretary of the M.M.F.-A.N.E. is Dr. George P. Swift, consultant, Watertown, Mass.

LETTER TO THE EDITOR

Mr. Nathaniel Hall, Technical Editor
METAL FINISHING
381 Broadway, Westwood, N. J.
Dear Mr. Hall:

We have read the interesting series of articles by Harold P. Preuss on "Synthetic Resins — The Backbone of Modern Finishes" which have appeared in recent issues of METAL FINISHING. These articles should provide the trade with useful information about resins which are available today.

In the first article of the series (June 1960) reference was made to the identification of synthetic resins. It was stated that some resins could be identified by holding a match to them. According to Mr. Preuss, however, "care should be exercised because cellulose nitrate is explosive when dry and in thin sections." This statement is misleading, and we do not believe that it is based on fact. The nitrocellulose used in the coating industry is a flammable material, but, according to the Bureau of Explosives and the Interstate Commerce Commission Regulations, soluble nitrocellulose, when wet with the prescribed amount of an alcohol, or in solution, is considered a flammable liquid and not an explosive. We agree that it is flammable; however, according to tests made by well-known, independent laboratories*, lacquer finishes containing cellulose nitrate when applied to wood and metal substrates at normal thickness (3-4 mils) do not propagate a flame to any appreciable distance beyond the area heated to kindling temperature. As a matter of fact, cellulose nitrate coatings were shown to have a flammability no greater than such conventional coatings as varnish, shellac, alkyds, etc.

I am sure that you will want to make every effort to acquaint your readers with these facts.

Very truly yours,
S. E. Sankey, Coatings Div.
Hercules Powder Co., Inc.
Wilmington, Del.

*Private communication to Hercules Powder Co.

OBITUARY

JOHN C. MILLER

John C. Miller, 72, founder of the *J. C. Miller Co.* in Grand Rapids, Mich., died recently of a heart attack.

Mr. Miller suffered the fatal attack while changing planes in Tampa, Fla., en route to his Palm Beach home, where he had made his permanent residence since 1957.

He is survived by his wife, Marie, two stepdaughters, Mrs. John M. Battjes and Mrs. Gordon Copp, three sisters, Mrs. Mead, Mrs. Marie McKinney and Mrs. Elizabeth Robinson, a brother, Albert M., and five grandchildren.

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Udylite Jr. 26′4″ overall, 15 stations, Hydraulic Lift, Tanks 42″ deep, ideal for most any plating or cleaning cycle.

SEMI-AUTOMATIC POLISHING EQUIPMENT

1—Production #101, 3 tandem 25 H.P. M.D.
1—Production #101, 2 tandem 15 H.P. M.D.
2—Production #101, 7½ & 10 H.P. M.D.
1—Hammond 4 Spindle
5—Acme A-2
2—Acme B-10
Hammond 4 Spindle w/pull back.

POLISHING MACHINES

1—Mitchell Double 20 H.P.
2—Divine VCS-3 H.P.
2—Divine VM-10 10 H.P.
1—L'Hommedieu #20A 5 H.P. vari-drive
1—L'Hommedieu #23 5 H.P. vari-drive
26—Various makes, models, 2, 3, 5, 7½, 10 & 15 H.P.
Hammond Double 7½ H.P.

RECTIFIERS & GENERATORS

2—2000 Amp. 40 Volts H.V.W. Comp.
1—2500 Amp. 6 volt Green w/control
2—2000/1000 amp., 6/12 v. G.E. New Selenium stacks, remote controls
5—Udylite 1500/750 amp. 6/12 v.
1—H.V.W. 1000 amp. 6 v.
4—Rapid 500 amp. 6 v. S.C. Full Control
1—R.A. 500 amp. 9 v. S.C. Full Control
3—R.A. 500 amp. 6 v. S.C. Full Control
2—G.E. 500 amp. 6 v. basic units
1—Udylite 500 amp. 6 v. self contained, full control

FINISHING EQUIPMENT

1—18″ x 36″ Abbott Rubber Lined M.D.
2—Roto-Finish Tumbling Barrels DW-60-36-2 comp. rubber lined, M.D.
1—Roto-Finish DW-22-36-1 M.D.
Large assortment of Baird, Crown, Globe, Henderson motor driven furnished with steel, wood or lined barrel.
1—Roto Finish Unloading chute
3—Chip Separators

MISCELLANEOUS

1—Daniels #3 rubber lined plating barrel w/new lucite cylinder
1—Noble Centrifugal Dryer, 12″ x 12″
Alsop 7″ 20 pad Stainless Steel Filter
Sparkler 1800 G.P.H. Cyanide Filter
Steel, Stainless Steel, Steel Koroseal or Rubber Lined or Lead Lined Tanks
Rheostats, Knife Switches, Back Stand Idlers
WE PURCHASE SURPLUS EQUIPMENT
WE WELCOME YOUR INQUIRIES

LINDALE
EQUIPMENT AND SUPPLY CORP.
504 SMITH ST., BROOKLYN 31, N. Y.
Phone: TRiangle 5-4353

Better Buys

Better Equipment

GENERATORS

1—10,000 Amps. 7 Volt.
1—10,000 Amps. 9 Volt.

FILTERS

1—18-48SC1
1—30-6048 Model 3
1—36-6048 RDR2

RECTIFIERS

1—1000 Amp. 0- 6 Volt
1—1000 Amp. 0-12 Volt

CHILLER

1—2 ton Frostrode chiller

PLATING MACHINES

1—Hanson-Van Winkle-Munning—two lane 64 inch lift. Adapted for copper-nickel and chrome
2—Semi-automatic nickel plater.
1—Semi-automatic — for copper, cadmium or zinc
1—Udylite Jr. — Fully automatic for zinc or cadmium — brass or nickel.
1—Udylite full automatic bi-nickel plater.

1—6000 Gal. Carbate Heat Exchanger.

Rheostats — 200 Amp. and up

Hanson-Van Winkle-Munning — Columbia

Ransohoff spiral dryers

All sizes — rubber, Koroseal lined and steel tanks.

~

PLATING SERVICE AND EQUIPMENT CORP.
1401 Conner Detroit 15, Mich.
Phone: Valley 3-1852

Save More IMMEDIATE SHIPMENT!

PLATERS

1—10000/5000 AMPERE, 6/12 VOLT, 40° **CHANDEYSSON,** Synch.
1—7500/3750 AMPERE 9/18 VOLT, **H-VW-M,** Synch. 40°.
1—6000/3000 AMPERE, 6/12 VOLT, **ELECTRIC PRODUCTS,** Synch.
1—5000/2500 AMPERE, 12/24 VOLT, **CHANDEYSSON,** Synch.
1—5000/2500 AMPERE, 6/12 VOLT, 25°C. **CHANDEYSSON,** Synch.
1—5000/2500 AMP., 9/18 V., 40°C., **CHANDEYSSON,** Synch.
1—4000/2000 Amp. 12/24 V. **CHANDEYSSON** 40° Synch.
1—4000/2000 AMPERE, 6/12 VOLT, **H-VW-M.,** Synch.
1—3000/1500 AMPERE, 12/24 VOLT, **CHANDEYSSON,** Synch.
1—2000/1000 AMPERE, 6/12 VOLT, **H-VW-M.** Synch.

ANODIZERS

1—1000 AMPERE, 40 VOLT. **CHANDEYSSON,** 25°C. and other sizes in stock for immediate delivery. Write for details.

RECTIFIERS

1—**H-VW-M** SELENIUM 5000 A., 6 V., S.C.F.C. 440/3/60.
2—**H-VW-M** SELENIUM 3000 A., 6 V., S.C.F.C. 440/3/60.
1—**NEW G. E.** 2000/1000 AMPS., 6/12 V. Remote Control 440/3/60 AC.
1—**RAPID,** Selenium 1500 Amps., 6 V. SC FC, 220/3/60.
12—**UDYLITE** No. UV-12-TD Basic, 1500/750 Amp., 12/24 V., Controls available.
2—**RAPID** 1500 AMP. Periodic reversers.
3—**RAPID** 500 AMP. Periodic reversers.

SPECIAL

1—**KREIDER** Centrifugal Drier with Heat.
1—R-100 **RONCI** Enameler.
3—**LASALCO** Ball Burnishers, Sizes 1, 2 & 4. Lined or unlined.
3—**HAMMOND** No. VRO-7 7½ H.P. Variable Speed Buffing Lathes.
2—**INDUSTRIAL** RDR-1 Rubber-Lined Filter. Sizes 10x28, 14x36.
2—**INDUSTRIAL** Type SC Filters for Cyanide. 18x48 and 18x36.
10—BUFFING LATHES — **HAMMOND, DIVINE, U. S.** etc. from 3 H.P. to 20 H.P. Single and variable speed.
3—**PRODUCTION** No. 101 Pipe Polishers, Individual or in tandem.
1—**PRODUCTION** Model A Pipe Polisher with feed troughs.
1—**HAMMOND** Pipe Polisher.
3—**STEVEN-BADER** Belt Polishers.
3—**AMERICAN** Blower Type HS Fans, Size 330-10.
8—**DUSKOP** Dust Collector Cabinets, Sizes No. 550, No. 850.
1—Model A **NIEHAUS** Steel fume separator.
1—NEW Model B **NIEHAUS** S.S. Fume Separator.
1—**H-VW-MUNNING** Type (Mechanical lift) full automatic, Plating Machine, 70′ long x 4′ wide x 36″ deep x 10½′ overall height.
1—**CROWN** 48x36, 2 Compartment horizontal tumbling barrel, lined or unlined.
2—**MERCIL** Nickel Plating Barrels 12″ x 36″ with R. L. Tanks.
3—**DANIELS** 30LS Plating Barrels.

M. E. BAKER CO.
Kirkland 7-5460
25 Wheeler St., Cambridge 38, Mass.

FINISHING EQUIPMENT COMPANY WANTED

Organization interested in acquiring manufacturing companies servicing the metal finishing industry. Interested in both small and large companies. All inquiries held confidential. Address: October 4, care Metal Finishing, 381 Broadway, Westwood, N. J.

ADDITIONAL LINES WANTED

Nationally known manufacturer with national sales organization would like additional lines to sell to metal finishing supply jobbers. Would consider any small equipment or accessory line. Address: October 3, care Metal Finishing, 381 Broadway, Westwood, N. J.

SITUATIONS WANTED

PLATING EXECUTIVE

SITUATION WANTED—Thirty-five years experience, capable of full responsibility. Can set up and get out production, maintain and analyze solutions of all types. Experience includes all kinds of oxidized finishes as well as antique finishes. Address: November 5, care Metal Finishing, 381 Broadway, Westwood, N. J.

FINISHING FOREMAN

SITUATION WANTED—Twenty years diversified experience. Age 42. Analytical control of solutions. Automatic and manual plating. Supervision has included organic finishing and polishing. Address: November 7, care Metal Finishing, 381 Broadway, Westwood, N. J.

PLATING ENGINEER

SITUATION WANTED—Seven years experience with major electronics companies including manufacturing engineering, manufacturing supervision, and development engineering. Specializing in precious metals, magnetic coatings for memory application and specialized plating. Age 31. Desire position in New Jersey or vicinity. Address: December 3, care Metal Finishing, 381 Broadway, Westwood, N. J.

METAL PROCESSING TECHNICIAN

SITUATION WANTED—Twenty years experience in all phases of metal processing. Technical knowledge of printed circuit plating and Government specifications. Can control and maintain all solutions. Metal polishing of all metals. Can solve any problems. Address: December 4, care Metal Finishing, 381 Broadway, Westwood, N. J.

PLATING EXECUTIVE

SITUATION WANTED—Fifteen years experience in the plating field. Fully familiar with all types of plating, such as copper, nickel, chrome, cadmium and bronze, brass and barrel plating. All good quality work. Address: November 6, care Metal Finishing, 381 Broadway, Westwood, N. J.

COMPTROLLER

SITUATION WANTED — Ten years experience in systems, budgets, taxes, standard and job costs, cost reduction, credits, complete comptroller. Ship functions. Presently divisional comptroller of a national manufacturing company. Address: October 15, care Metal Finishing, 381 Broadway, Westwood, N. J.

PLATING-FINISHING EXECUTIVE

SITUATION WANTED — Excellent technical, operational and business background. Desire connection as incentive type employee or partnership within fifty miles of New York City. Can invest moderately. With financial backing, in position to create new profitable business. Address: October 13, care Metal Finishing, 381 Broadway, Westwood, N. J.

SITUATIONS OPEN

CHEMIST
RESEARCH, DEVELOPMENT AND TECHNICAL SERVICE

SITUATION OPEN—Midwest manufacturer of metal cleaning, degreasing and surface treating chemicals has a challenging opportunity for a chemist thoroughly familiar with the formulation and use of these types of products. Advancement with this progressive company will depend upon the ability and initiative of the man selected for this position. BS degree required, advanced degree preferred. Salary open. All replies held confidential. Address: December 1, care Metal Finishing, 381 Broadway, Westwood, N. J.

BUFF SALESMAN

SITUATION OPEN—To sell buffs to manufacturers in N.Y., N.J., Pa., Del. and Md. Requires knowledge or experience in buffing operations, adaptation of buffs for specific uses as well as familiarity with buffing compounds and construction of buffing wheels. Area needs careful study and analysis to determine potential. Knowledge and experience in metal finishing is more important than sales experience. Salary and incentive plus travel expense. Please submit resume and salary requirement. Address: December 2, care Metal Finishing, 381 Broadway, Westwood, N. J.

SALES ENGINEERS

SITUATIONS OPEN—Outstanding opportunity for aggressive sales engineers by national manufacturer of metal cleaning equipment and chemicals. Exclusive territories available due to new expansion program. Excellent salary, draw, and commission arrangement. State full details, experience. Replies held confidential. Address: October 8, care Metal Finishing, 381 Broadway, Westwood, N. J.

PLATING SUPERVISOR

SITUATION OPEN—Plating specialist, qualified in Production Engineering. Thoroughly experienced in copper, nickel, chrome, silver and gold — barrel, rack and automatic plating of small parts. Trouble shooting, maintenance and handling personnel. Strong working background methods and cost reduction knowledge and rack designing. B. S. degree in chemistry desirable. Permanent opportunity. Long established job shop in New York area. $9,000 start. Address: October 10, care Metal Finishing, 381 Broadway, Westwood, N. J.

PLATER

SITUATION OPEN—Job shop plating foreman. Must be experienced in copper, nickel and chrome on small parts, still and automatic. Must be qualified to supervise department and help solve plating problems. Willing, hard worker. Excellent opportunity for advancement. New York area. Address: October 11, care Metal Finishing, 381 Broadway, Westwood, N. J.

SUPERVISOR

SITUATION OPEN—Must have heavy experience in hard chrome plating, special fixture and anode set-up for production and one-shot jobs.

Supervise quality control for general plating from gold to zinc, done to government specs. Opportunity for management staff position in the future. Large job shop located southeast Pennsylvania. Require full resume including experience and salary desired. Address: November 8, care Metal Finishing, 381 Broadway, Westwood, N. J.

WANTED

METAL CLEANING EQUIPMENT SALES SPECIALISTS
for new Conveyorized Ultrasonics

We are now ready to enter into a full-scale National marketing program on our revolutionary AutoSonex metal cleaning equipment, and require the services of the most experienced, intelligent, and successful sales representatives in each marketing area.

AutoSonex is a new packaged cleaning machine which employs conveyorized ultrasonics to introduce automation to the cleaning process for the first time. It provides remarkable advantages in better, more efficient cleaning at significant savings of time, space, cost, manpower, and maintenance. Live inquiries from hundreds of manufacturers as a result of initial stories in various magazines, give us reason to believe there is a vast, virgin market for this product — as well as for numerous additional products and applications now in advanced stages of development.

If you can qualify as a top man with the ability for creative sales engineering and determination to do a top job, please write today in detail, outlining territory covered, experience and background, and if you are an individual or organization. Your reply treated in strictest confidence.

AUTOSONICS, INC.
4217 CHESTNUT STREET
PHILADELPHIA 4, PA.

SALESMEN WANTED

TRANSPORTATION CLEANING PRODUCTS SALES MANAGER

New division of Economics Laboratory, Inc. has opening for experienced salesman in Airline Cleaning Products field. Background consisting of complete knowledge of airline cleaning problems and contacts with national airline companies. Must be capable of administration and expansion of this sales program on a national basis. Must be of high caliber with a successful sales background with present earnings in excess of $10,000 annually.

INDUSTRIAL SALESMEN

Have five (5) salesmen positions open for experienced, Industrial Salesmen with a sales following. Desire applicants who reside in Cleveland, Ohio; Chicago, Ill.; St. Louis, Mo.; Detroit, Mich.; and Minneapolis or St. Paul, Minn. Must have successful sales background of products for metal finishing and processing; phosphate coating; conversion coating and special cleaning products for the Industrial field.

EL

We are one of America's largest cleaning compounders. 35 years in the business doing $23 million in sales last year with five plants strategically located in the U.S.A. and Canada. Salaries are open for these positions, travel expenses paid, plus excellent fringe benefits. All persons replying to this ad will be promptly contacted and ALL REPLIES WILL BE HELD CONFIDENTIAL.

Please mail complete resume of your work history with references, current salary, salary desired to Personnel Department.

ECONOMICS LABORATORY, INC.

914 GUARDIAN BUILDING **ST. PAUL 1, MINNESOTA**

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JANUARY-DECEMBER, 1960

(Compiled by N. Hall, Technical Editor, and I. Oquendo, Equipment and News Editor)

In this index all material that appeared in the January through December 1960 issues of *Metal Finishing* is listed according to subject matter, with cross references where required. Following each listing will be found a letter indicating the manner in which the material was published, as follows:

(S)—Shop Problem
(R)—Recent Development
(P)—Patent
(M)—Manufacturers' Literature
(B)—Book
(A)—Abstract from Foreign Literature

Any reference not followed by a letter was a feature article. The numbers in the right-hand column refer to the month and page numbers; 6-85 means June issue, page 85, etc.

CHROMIUM PLATING

CLEANING

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COLORED SURFACE TREATMENTS

COMPOSITIONS, BUFFING AND POLISHING

CONVERSION SURFACE TREATMENTS

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COSTS AND GENERAL

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